



**US Army Corps
of Engineers®**
NEW YORK DISTRICT

FY'05 Dormitory Replacement

Thule Air Base, Greenland

Specifications

Prepared for:

**US Army Corps of Engineers
New York Division
Contract: DACA31-99-D-0007**

Prepared by:



ChallengeUs.

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November 2004

US ARMY ENGINEER DISTRICT, NEW YORK

INVITATION FOR BIDS NO.

CHECK LIST FOR BIDDERS

ATTACHED IS IFB NO.

**FY'05 DORMITORY REPLACEMENT
THULE AIR BASE, GREENLAND**

ALL INFORMATION REQUIRED BY THE TERMS OF THIS SOLICITATION MUST BE FURNISHED. MISTAKES OR OMISSIONS MAY RENDER YOUR OFFER INELIGIBLE FOR AWARD. IMPORTANT ITEMS FOR YOU TO CHECK ARE INCLUDED IN BUT NOT LIMITED TO THOSE LISTED BELOW. THIS INFORMATION IS FURNISHED ONLY TO ASSIST YOU IN SUBMITTING A PROPER BID

☐ HAVE YOU ACKNOWLEDGED ALL AMENDMENTS?

☐ HAVE YOU COMPLETED THE "REPRESENTATIONS AND CERTIFICATIONS" (SECTION 00600) PORTION OF THE SOLICITATION?

☐ IS YOUR DUNS NUMBER LISTED ON THE STANDARD FORM 1442?

☐ IS YOUR BID PROPERLY SIGNED?

☐ IS YOUR BID GUARANTEE PROPERLY SIGNED BY BOTH THE BIDDER AND SURETY AND ARE ALL SEALS AFFIXED?

☐ DO THE BID BOND AND ACCOMPANYING DOCUMENTS BEAR SIGNATURES AND SEALS AFFIXED **AFTER** THE DOCUMENT WAS GENERATED, AS OPPOSED TO COMPUTER PRINTER-GENERATED SIGNATURES AND/OR SEALS?

☐ HAVE YOU ENSURED THAT YOU HAVE NOT RESTRICTED YOUR OFFER BY ALTERING THE PROVISIONS OF THE SOLICITATION?

☐ WHEN REQUIRED, HAVE YOU ENTERED A UNIT PRICE FOR EACH PRICE ITEM? (THE SOLICITATION SPECIFICALLY STATES WHEN THIS IS NECESSARY.)

☐ ARE DECIMALS IN YOUR PRICES IN THE PROPER PLACE? ARE YOUR FIGURES LEGIBLE?

___ IF YOU HAVE MADE ERASURES OR CORRECTIONS ON YOUR BID, ARE THEY INITIALED BY THE PERSON SIGNING THE BID?

___ DOES THE ENVELOPE CONTAINING YOUR BID PROPERLY IDENTIFY THAT IT IS A SEALED BID AND DOES IT CONTAIN THE CORRECT SOLICITATION NUMBER AND BID OPENING TIME?

___ WILL YOUR OFFER ARRIVE ON TIME? (SEE PARAGRAPH ENTITLED "LATE SUBMISSIONS, MODIFICATIONS, AND WITHDRAWALS OF BIDS" IN THE INSTRUCTIONS, CONDITIONS, AND NOTICES TO BIDDERS, SECTION 00100 OF THE SOLICITATION.)

NOTE: THERE ARE INCREASED SECURITY MEASURES AT JACOB K. JAVITS FEDERAL BUILDING, 26 FEDERAL PLAZA THAT MAY AFFECT THE TIME IT TAKES TO ENTER THE BUILDING. BIDDERS IS RESPONSIBLE TO ENSURE THAT ITS BID IS SUBMITTED TIMELY.

IFB No.

NEW YORK DISTRICT
CORPS OF ENGINEERS
NEW YORK, NEW YORK 10278-0090

INVITATION FOR BIDS
FOR
**FY'05 DORMITORY REPLACEMENT
THULE AIR BASE, GREENLAND**

1. Attached is INVITATION FOR BIDS NO.
2. BIDS MUST BE SET FORTH full, accurate, and complete information as required by this Request for Proposal, including attachments. The penalty for making false statements in bids is prescribed under Title 18, United States Code, Section 1001.
3. SUBMISSION OF BIDS: Complete details concerning proper submission of bids are contained in the INSTRUCTIONS, CONDITIONS, AND NOTICES TO BIDDERS (Section 00100).
4. Note the REQUIREMENT FOR AFFIRMATIVE ACTION of the EQUAL OPPORTUNITY clause as it applies to the contract resulting from this solicitation. (See paragraph NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY in Section 00100 of this IFB).
5. REPRESENTATIONS AND CERTIFICATIONS – SECTION 00600
Bidders are required to complete the REPRESENTATIONS AND CERTIFICATIONS and submit them with their bids.

Within Section 00600, note in particular the PROHIBITION OF SEGREGATED FACILITIES. Failure of a bidder or offeror to agree to the certification will render his bid or offer non-responsive to the terms of solicitations involving awards of contracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity Clause (1984 APR).

6. Please review all bonds and accompanying documents required to be submitted. Bonds, Powers of Attorney, statements of authenticity and continuing validity, and all related documents **MUST NOT** bear computer printer-generated signatures and/or seals. Documents bearing signatures and/or seals generated as part of a document, as opposed to being affixed to the document **after** its generation, will not be accepted. Submission of such documents may render the bid or offer non-responsive and ineligible for award.

<u>SECTION</u>	<u>TITLE</u>
00010	SF 1442 AND BIDDING SCHEDULE
00100	INSTRUCTIONS, CONDITIONS, AND NOTICE TO BIDDERS
00600	REPRESENTATIONS AND CERTIFICATIONS
00700	CONTRACT CLAUSES
00800	SPECIAL CONTRACT REQUIREMENTS
 <u>DOCUMENTS 00 - INTRODUCTORY, BIDDING, AND CONTRACT REQUIREMENTS</u>	
00901	SUMMER PORT OPERATIONS
00902	TRANSPORTATION FACILITIES AND ACTIVITIES
	REIMBURSABLE EXPENSES
 <u>DIVISION 01 - GENERAL REQUIREMENTS</u>	
01312A	QUALITY CONTROL SYSTEM (QCS)
01320	A PROJECT SCHEDULE
01330	SUBMITTAL PROCEDURES
01355A	ENVIRONMENTAL PROTECTION
01415	METRIC MEASUREMENTS
01420	SAFETY
01451A	CONTRACTOR QUALITY CONTROL
01452	TESTING FOR MECHANICAL AND ELECTRICAL SYSTEMS
01572	CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT
01670	RECYCLED / RECOVERED MATERIALS

01780A	CLOSEOUT SUBMITTALS
01850	CONTRACTOR WARRANTY MANAGEMENT

DIVISION 02 - SITE CONSTRUCTION

02217A	FOUNDATION PREPARATION
02220	DEMOLITION
02300	EARTHWORK
02373	GEOTEXTILE
02510A	WATER DISTRIBUTION SYSTEM
02531	SANITARY SEWERS
02554A	ABOVEGROUND HEAT DISTRIBUTION SYSTEM
02722A	AGGREGATE AND/OR GRADED-CRUSHED AGGREGATE BASE COURSE

DIVISION 03 – CONCRETE

03101A	FORMWORK FOR CONCRETE
03200A	CONCRETE REINFORCEMENT
03307A	CONCRETE FOR MINOR STRUCTURES
03410A	PRECAST/PRESTRESSED CONCRETE FLOOR AND ROOF UNITS
03415A	PRECAST-PRESTRESSED CONCRETE

DIVISION 05 – METAL

05090A	WELDING, STRUCTURAL
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05120	STRUCTURAL STEEL
05210A	STEEL JOISTS
05310	STEEL DECKS
05400	COLD-FORMED METAL FRAMING
05500A	MISCELLANEOUS METAL

DIVISION 06 - WOOD AND PLASTICS

06100N	ROUGH CARPENTRY
06200A	FINISH CARPENTRY
06650	SOLID POLYMER (SOLID SURFACING) FABRICATIONS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07212N	MINERAL FIBER BLANKET INSULATION
07410N	METAL ROOF AND INSULATED WALL PANELS
07840	FIRESTOPPING
07920	JOINT SEALANTS

DIVISION 08 - DOORS AND WINDOWS

08110	STEEL DOORS AND FRAMES
08210	WOOD DOORS
08560	PLASTIC WINDOWS
08710	DOOR HARDWARE
08800	GLAZING

DIVISION 09 – FINISHES

09100	METAL SUPPORT ASSEMBLIES
09250	GYPSUM BOARD
09310	CERAMIC TILE, QUARRY TILE, AND PAVER TILE
09510	ACOUSTICAL CEILINGS
09650	RESILIENT FLOORING
09680	CARPET
09720	WALLCOVERINGS
09900	PAINTS AND COATINGS
09915	COLOR SCHEDULE

DIVISION 10 – SPECIALTIES

10260	WALL AND CORNER GUARDS
10440	INTERIOR SIGNAGE
10500	LOCKERS
10800	TOILET ACCESSORIES

DIVISION 12 – FURNISHINGS

12490A	WINDOW TREATMENT
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DIVISION 13 - SPECIAL CONSTRUCTION

13280A	ASBESTOS ABATEMENT
13282N	LEAD IN CONSTRUCTION
13851A	FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE
13920A	FIRE PUMPS
13930A	WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION
13975N	STANDPIPE SYSTEMS

DIVISION 15 – MECHANICAL

15080A	THERMAL INSULATION FOR MECHANICAL SYSTEMS
15400A	PLUMBING, GENERAL PURPOSE
15556A	FORCED HOT WATER HEATING SYSTEMS USING WATER AND STEAM HEAT EXCHANGERS
15895	AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM
15951A	DIRECT DIGITAL CONTROL FOR HVAC
15990A	TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS
15995A	COMMISSIONING OF HVAC SYSTEMS

DIVISION 16 – ELECTRICAL

16415A	ELECTRICAL WORK, INTERIOR
16710A	PREMISES DISTRIBUTION SYSTEM

16711A	TELEPHONE SYSTEM, OUTSIDE PLANT
16713N	FIBER OPTIC (FO) OUTSIDE PLANT (OSP)
16770	RADIO AND PUBLIC ADDRESS SYSTEMS
16815A	CABLE TELEVISION PREMISES DISTRIBUTION SYSTEM

-- End of Project Table of Contents --

SOLICITATION, OFFER, AND AWARD <i>(Construction, Alteration, or Repair)</i>	1. SOLICITATION NO. W912DS-05-B-0004	2. TYPE OF SOLICITATION <input checked="checked" type="checkbox"/> SEALED BID (IFB) <input type="checkbox"/> NEGOTIATED (RFP)	3. DATE ISSUED 30-Nov-2004	PAGE OF PAGES 1 OF 98
IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.				
4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO. W16ROE-4308-5191		6. PROJECT NO.	
7. ISSUED BY USA ENGINEER DISTRICT, NEW YORK ATTN: CENAN-CT ROOM 1843 26 FEDERAL PLAZA NEW YORK NY 10278 TEL: 212-264-0238 FAX: 212-264-3013		CODE W912DS	8. ADDRESS OFFER TO <i>(If Other Than Item 7)</i> CODE <div style="text-align: center; font-weight: bold;">See Item 7</div>	
9. FOR INFORMATION CALL:	A. NAME NORMA J SMITH	B. TELEPHONE NO. <i>(Include area code)</i> (NO COLLECT CALLS) 212-264-0242		
SOLICITATION				
NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".				
10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS <i>(Title, identifying no., date):</i> New Dormitory at Thule Air Base, Greenland This Procurement is Unrestricted to bidder's in the United States and Denmark only. All questions should be sent to the Contract Specialist, Norma Smith, via email to norma.j.smith@usace.army.mil Note New Requirement: Bonds, Powers of Attorney, statements of authenticity and continuing validity, and all related documents MUST NOT bear computer printer-generated signatures and/or seals. Documents bearing signatures and/or seals generated as part of a document, as opposed to being affixed to the document after its generation, will not be accepted. Submission of such documents may render the bid or offer non-responsive and ineligible for award. Please review all bonds and accompanying documents required to be submitted. A dual bid opening will be held simultaneously in Denmark and at the New York District, on 6 January 2005, at 10am US, Eastern Standard Time and 4pm Denmark time. Bid opening at the New York District will be held in Room 1841 of 26 Federal Plaza, New York, NY 10278. US offerors are strongly encouraged to arrive early due to security measures at 26 Federal Plaza. Additionally, offerors submitting through mail or carrier should ensure that submittals arrive timely given the security measures mentioned above.				
11. The Contractor shall begin performance within <u>10</u> calendar days and complete it within <u>720</u> calendar days after receiving <input type="checkbox"/> award, <input checked="checked" type="checkbox"/> notice to proceed. This performance period is <input checked="checked" type="checkbox"/> mandatory, <input type="checkbox"/> negotiable. <i>(See _____.)</i>				
12 A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? <i>(If "YES," indicate within how many calendar days after award in Item 12B.)</i> <input checked="checked" type="checkbox"/> YES <input type="checkbox"/> NO			12B. CALENDAR DAYS 10	
13. ADDITIONAL SOLICITATION REQUIREMENTS: A. Sealed offers in original and <u>2</u> copies to perform the work required are due at the place specified in Item 8 by <u>10:00 AM</u> (hour) local time <u>06 Jan 2005</u> (date). If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due. B. An offer guarantee <input checked="checked" type="checkbox"/> is, <input type="checkbox"/> is not required. C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference. D. Offers providing less than <u>120</u> calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.				

SOLICITATION, OFFER, AND AWARD (Continued) <i>(Construction, Alteration, or Repair)</i>										
OFFER (Must be fully completed by offeror)										
14. NAME AND ADDRESS OF OFFEROR <i>(Include ZIP Code)</i>					15. TELEPHONE NO. <i>(Include area code)</i>					
					16. REMITTANCE ADDRESS <i>(Include only if different than Item 14)</i> See Item 14					
CODE		FACILITY CODE								
17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within _____ calendar days after the date offers are due. <i>(Insert any number equal to or greater than the minimum requirements stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)</i>										
AMOUNTS		SEE SCHEDULE OF PRICES								
18. The offeror agrees to furnish any required performance and payment bonds.										
19. ACKNOWLEDGMENT OF AMENDMENTS <i>(The offeror acknowledges receipt of amendments to the solicitation -- give number and date of each)</i>										
AMENDMENT NO.										
DATE										
20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER <i>(Type or print)</i>					20B. SIGNATURE			20C. OFFER DATE		
AWARD (To be completed by Government)										
21. ITEMS ACCEPTED:										
22. AMOUNT		23. ACCOUNTING AND APPROPRIATION DATA								
24. SUBMIT INVOICES TO ADDRESS SHOWN IN <i>(4 copies unless otherwise specified)</i>				ITEM		25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO <input type="checkbox"/> 10 U.S.C. 2304(c) <input type="checkbox"/> 41 U.S.C. 253(c)				
26. ADMINISTERED BY		CODE				27. PAYMENT WILL BE MADE BY:		CODE		
CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE										
<input type="checkbox"/> 28. NEGOTIATED AGREEMENT <i>(Contractor is required to sign this document and return _____ copies to issuing office.)</i> Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications or incorporated by reference in or attached to this contract.						<input type="checkbox"/> 29. AWARD <i>(Contractor is not required to sign this document.)</i> Your offer on this solicitation, is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.				
30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN <i>(Type or print)</i>						31A. NAME OF CONTRACTING OFFICER <i>(Type or print)</i>				
30B. SIGNATURE			30C. DATE			TEL:		EMAIL:		
						31B. UNITED STATES OF AMERICA BY		31C. AWARD DATE		

Section 00010 - Solicitation Contract Form

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0001	FY05 Replace Dormitory Thule Air Base FFP All work for the FY05 Dormitory Replacement as described in the plans and specifications, including all plant, labor and materials, complete and excluding Items Nos. 2, 3, 4 and 5 below and Options. PURCHASE REQUEST NUMBER: W16ROE-4308-5191	1	Lump Sum		
					<hr/>
NET AMT					

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0002	FY05 Replace Dormitory Thule Air Base FFP Site work, all work outside the five-foot line of the building perimeter, inclusive of demolition (As defined by the Civil (C-series drawings and AD-101 and AD-102 and specifications)).	1	Lump Sum		
					<hr/>
NET AMT					

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0003	FY05 Replace Dormitory Thule Air Base FFP All work for the Final Record Drawing Submission (See paragraph 11 of Section 00800).	1	Lump Sum		

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0004	Transportation FFP Transportation: All Government Furnished Transportation From Norfolk, Virginia to Thule Air Base.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0004AA	Transportation Norfolk to Thule FFP Transportation Norfolk to Thule, Sealift + Port Handling, General Cargo. Unit price estimated at rate of \$167.00.		Measurement Ton		

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0004AB	Transportation Norfolk to Thule FFP Transportation Norfolk to Thule, Sealift + Port Handling, Wood Products, Unboxed. Unit price estimated at rate of \$162.00.		Measurem ent Ton		

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0004AC	Transportation Norfolk to Thule FFP Transportation Norfolk to Thule, Sealift + Port Handling, Metal Products, Unboxed. Unit price estimated at rate of \$170.00.		Measurem ent Ton		

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0004AD	Transportation Norfolk to Thule FFP Transportation Norfolk to Thule, Sealift + Port Handling, Vehicles 10,000 lbs or less. Unit price estimated at rate of \$135.00.		Measurem ent Ton		

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0004AE	Transportation Norfolk to Thule FFP Transportation Norfolk to Thule, Sealift + Port Handling, Vehicles Over 10,000 lbs. Unit price estimated at rate of \$137.00.		Measurment Ton		
					<hr/>
NET AMT					

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0004AF	Transportation Thule to Norfolk FFP Transportation Thule to Norfolk, Sealift + Port Handling (Retro-grade) General Cargo. Unit price estimated at rate of \$167.00		Measurment Ton		
					<hr/>
NET AMT					

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0004AG			Measurem ent Ton		

Transportation Thule to Norfolk
FFP

Transportation Thule to Norfolk, Sealift + Port Handling (Retro-grade) Wood
Products, Unboxed. Unit price estimated at rate of \$162.00.

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0004AH			Measurem ent Ton		

Transportation Thule to Norfolk
FFP

Transportation Thule to Norfolk, Sealift + Port Handling (Retro-grade) Metal
Products, Unboxed. Unit price estimated at rate of \$170.00.

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0004AJ			Measurem ent Ton		

Transportation Thule to Norfolk
FFP

Transportation Thule to Norfolk, Sealift + Port Handling (Retro-grade) Vehicles
10,000 lbs or less. Unit price estimated at rate of \$135.00.

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0004AK	Transportation Thule to Norfolk FFP Transportation Thule to Norfolk, Sealift + Port Handling (Retro-grade) Vehicles Over 10,000 lbs. Unit price estimated at rate of \$137.00.		Measurem ent Ton		

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005	FY05 Replace Dormitory Thule Air Base FFP Transportation: Furnished From Denmark to Thule AB				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AA	General Cargo- Unitized FFP Cargo under 600 kg/CM. Unit price estimated at rate of \$455.00.		Cubic Meter		

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AB	General Cargo- Unitized FFP Cargo over 600 kg/CM. Unit price estimated at rate of \$0.75.		Kilogram		

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AC	General Cargo-Non- Unitized FFP Cargo under 600 kg/CM. Unit price estimated at rate of \$520.00.		Cubic Meter		

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AD	General Cargo-Non- Unitized FFP Cargo over 600 kg/CM. Unit price estimated at rate of \$0.88.		Kilogram		

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AE	Lumber - Unitized FFP		Cubic Meter		
	Cargo under 800 kg/CM. Unit price estimated at rate of \$455.00.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AF	Lumber - Unitized FFP				
	Cargo over 800 kg/CM. Unit price estimated at rate of \$0.55.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AG	Lumber Non-Unitized FFP		Cubic Meter		
	Cargo under 800 kg/CM. Unit price estimated at rate of \$510.00.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AH	Lumber Non-Unitized FFP		Kilogram		
	Cargo over 800 kg/CM. Unit price estimated at rate of \$0.60.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AJ	Lumber Non-Unitized FFP		Kilogram		
	Cement - Unitized. Unit price estimated at rate of \$0.40.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AK	Motor Vehicles FFP		Each		
	Less than 1000 KG. Unit price estimated at rate of \$8000.00.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AL	Motor Vehicles FFP		Each		
	1001 through 1200 KG. Unit price estimated at rate of \$11,000.00.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AM	Motor Vehicles FFP		Each		
	1201 through 1500 KG. Unit price estimated at rate of \$12,000.00.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AN	Motor Vehicles FFP		Each		
	1501 through 2500 KG. Unit price estimated at rate of \$14,000.00.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AP	Heavy Machinery FFP		Square Meter		
	Less than 2500 KG. Unit price estimated at rate of \$570.00.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AQ	Heavy Machinery FFP		Square Meter		
	2501 through 7500 KG. Unit price estimated at rate of \$570.00.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005AR	Heavy Machinery FFP		Square Meter		
	7501 through 15000 KG. Unit price estimated at rate of \$1,275.00.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0006		1	Lump Sum		
OPTION	OPTIONAL BID ITEM No. 1 FFP Deduct for all interior finish out work complete for (1) one SNCO module, Room 301. See Note 11 for further description of this option.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0007		1	Lump Sum		
OPTION	OPTIONAL BID ITEM No. 2 FFP Deduct for all interior finish out work complete for (1) one SNCO module, Room 302. See Note 11 for further description of this Option.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0008		1	Lump Sum		
OPTION	OPTIONAL BID ITEM No. 3 FFP Deduct for all interior finish out work complete for (1) one SNCO module, Room 303. See Note 11 for further description of this Option.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0009		1	Lump Sum		
OPTION	OPTIONAL BID ITEM No. 4 FFP Deduct for all interior finish out work complete for (1) one SNCO module, Room 304. See Note 11 for further description of this Option.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0010		1	Lump Sum		
OPTION	OPTIONAL BID ITEM No. 5 FFP All landscaping work completed in accordance with drawings L-101 and L-501 and specifications.				

NET AMT

FOB: Destination

TOTAL BID

TOTAL BASE BID PRICE FOR LINE ITEMS 0001- 0005

\$ _____

TOTAL BASE BID WITH OPTIONAL BID ITEMS 1 THROUGH 5, LINE ITEMS 0001- 0010

\$ _____

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0011		1	Lump Sum		
OPTION	OPTIONAL BID ITEM No. 6 FFP Complete the construction in 540 calendar days in lieu of 720 calendar days.				

NET AMT

FOB: Destination

NOTES

NOTES:

1. *Explanation of Units:

CM is cubic meters KG is kilograms
M2 is meters squared Measurement Ton (40 cubic feet) which equals 1.12 cubic meters

2. "Transportation from Denmark" means that the U.S. Embassy will provide a ship from Denmark to Thule AB, GL; however, it is not free. The Contractor shall reimburse the U.S. Embassy in Denmark the actual carrier cost for the transportation, the. This is not considered Government Furnished Transportation.

3. Bids may be in U.S. dollars or Danish Kroners. DO NOT PROPOSE IN TWO CURRENCIES. The currency used shall be indicated on the Price Schedule. For the purpose of comparing bids, the Contracting Officer will use the exchange rate on the day of the Bid Opening.

4. Construction Award will not include Government Furnished Transportation.

5. Contractors not utilizing Government Furnished Transportation shall include shipping costs in their Base Bid Items, as applicable. In such cases, the applicable transportation price schedule should be marked "NOT APPLICABLE".

6. The Contractor shall be billed for all quantities over the amount stated in the bid items for Government Furnished. Transportation or shall ship at his own expense through private carrier all items over the amounts stated in the bid items.

7. The low bidder for purposes of award will be the conforming responsible bidder offering the lowest amount for the Base Bid Item plus all Optional Bid Items, except for Optional Item No. 6 (CLIN 0011).

8. The minimum construction award will be the amount bid for the Base Bid Items.

9. Bidders are required to bid on the Base Bid and all Optional Bid Items or their bids will be rejected.

10. Bidders are reminded that they must bid on the issued plans and specifications as amended. Any deviations, conditions or attachments made by the bidder himself thereto may render the bid non-responsive and be cause for its rejection.

11. Refer to plan 1 of Sheet A-401 of the drawings for a typical SNCO Module. This deductive alternate shall exclude, window, radiator, finishes for exterior walls, partition walls between modules and partition walls adjacent to the corridor. Refer to 1/A-401 for the extent of (1) one typical SNCO module. Refer to 1/A-405 for the typical SNCO shell unit. Provide 20 mm empty conduit from panel board to proposed unit panel board location. Wiring to be provided for future module unit finish-out. Provide 25 mm sleeve for LAN, 25 mm sleeve for telephone, 20 mm sleeve for Fire system, 20 mm sleeve for CATV and 20 mm sleeve for future secured LAN (minimum 1 meter from existing LAN). Hot and cold water risers with valved and capped branch outlets for each bathroom group shall be provided. Sanitary and vent stacks with capped branch connections to future bathroom fixture groups shall also be provided. All HW heating piping and all HW heating devices are to be installed. This applies to piping specifically for this module and for piping passing through this module to other rooms. The ventilation ducts are to be stubbed at corridor

partition with balancing devices added to enable the system(s) to be set up and balanced. Balancing devices can be removed if not required for the total module finish-out. Ductwork will in turn be extended as currently depicted in M-series drawings for the complete module finish-out. Pendant type sprinkler heads to be provided for this module in the locations as shown on the fire protection drawings with the intent to replace the existing drop riser.

12.Option #5: At any time prior to 180 calendar days after award of the contract, the Government at its option, may direct the Contractor, by written order to perform the work and/or services provided under Option #5.

13.Option #1, 2, 3, 4 & 6: At any time prior to 30 calendar days after award of the contract, the Government at its option, may direct the Contractor, by written order, to perform the work and/or services provided under these Options.

14. All pallets and containers used for the transportation of contractor's cargo from Denmark shall be the contractor's responsibility and the contractor's expense.

15. Optional Bid Item No. 6, will not be used for the purposes of determining the low bidder.

16.Line Item Number 0003 is pre-priced at \$10,000, it's a firm fixed line item, and the price shown may not be changed, see paragraph 11(i) of Section 00800.

Section 00100 - Bidding Schedule/Instructions to Bidders

CLAUSES INCORPORATED BY REFERENCE

52.204-6	Data Universal Numbering System (DUNS) Number	OCT 2003
52.214-3	Amendments To Invitations For Bids	DEC 1989
52.214-4	False Statements In Bids	APR 1984
52.214-5	Submission Of Bids	MAR 1997
52.214-6	Explanation To Prospective Bidders	APR 1984
52.214-7	Late Submissions, Modifications, and Withdrawals of Bids	NOV 1999
52.214-12	Preparation Of Bids	APR 1984
52.214-18	Preparation of Bids-Construction	APR 1984
52.214-19	Contract Award-Sealed Bidding-Construction	AUG 1996
52.214-34	Submission Of Offers In The English Language	APR 1991
52.236-26	Preconstruction Conference	FEB 1995

CLAUSES INCORPORATED BY FULL TEXT

52.216-1 TYPE OF CONTRACT (APR 1984)

The Government contemplates award of a Firm Fixed Price type contract resulting from this solicitation.

(End of clause)

52.233-2 SERVICE OF PROTEST (AUG 1996)

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from Ella D. Snell, U.S. Army Corps of Engineers, Room 1843, Contracting Division, 26 Federal Plaza, New York, NY 10278-0090.

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

(End of provision)

52.236-27 SITE VISIT (CONSTRUCTION) (FEB 1995)

(a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigations and Conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed.

(b) Site visits may be arranged during normal duty hours by contacting:

Name: **Stella Marco**

Address: **26 Federal Plaza, PPMD, New York, New York 10278-0090**

Telephone: (212) 264-8393

(End of provision)

52.252-1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998)

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by paragraph identifier and provide the appropriate information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this/these address(es):

www.arnet.gov/far
<http://farsite.hill.af.mil>
<http://www.dtic.mil/dfars>

(End of provision)

52.252-5 AUTHORIZED DEVIATIONS IN PROVISIONS (APR 1984)

(a) The use in this solicitation of any Federal Acquisition Regulation (48 CFR Chapter 1) provision with an authorized deviation is indicated by the addition of "(DEVIATION)" after the date of the provision.

(b) The use in this solicitation of any Federal Acquisition Regulation (48 CFR Chapter 1) provision with an authorized deviation is indicated by the addition of "(DEVIATION)" after the name of the regulation.

(End of provision)

Section 00600 - Representations & Certifications

CLAUSES INCORPORATED BY REFERENCE

52.203-11	Certification And Disclosure Regarding Payments To Influence Certain Federal Transactions	APR 1991
252.209-7001	Disclosure of Ownership or Control by the Government of a Terrorist Country	SEP 2004
252.247-7024	Notification Of Transportation Of Supplies By Sea	MAR 2000

CLAUSES INCORPORATED BY FULL TEXT

52.203-2 CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (APR 1985)

(a) The offeror certifies that --

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to --

(i) Those prices,

(ii) The intention to submit an offer, or

(iii) The methods of factors used to calculate the prices offered:

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory --

(1) Is the person in the offeror's organization responsible for determining the prices offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision; or

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision _____ (insert full name of person(s) in the offeror's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the offeror's organization);

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision.

(c) If the offeror deletes or modifies subparagraph (a)(2) of this provision, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

(End of clause)

52.204-5 WOMEN-OWNED BUSINESS (OTHER THAN SMALL BUSINESS) (MAY 1999)

(a) Definition. Women-owned business concern, as used in this provision, means a concern that is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of its stock is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

(b) Representation. [Complete only if the offeror is a women-owned business concern and has not represented itself as a small business concern in paragraph (b)(1) of FAR 52.219-1, Small Business Program Representations, of this solicitation.] The offeror represents that it () is a women-owned business concern.

(End of provision)

52.209-5 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (DEC 2001)

(a)(1) The Offeror certifies, to the best of its knowledge and belief, that-

(i) The Offeror and/or any of its Principals-

(A) Are () are not () presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have () have not (), within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are () are not () presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in paragraph (a)(1)(i)(B) of this provision.

(ii) The Offeror has () has not (), within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

This Certification Concerns a Matter Within the Jurisdiction of an Agency of the United States and the Making of a False, Fictitious, or Fraudulent Certification May Render the Maker Subject to Prosecution Under Section 1001, Title 18, United States Code.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

(End of provision)

52.215-6 PLACE OF PERFORMANCE (OCT 1997)

(a) The offeror or respondent, in the performance of any contract resulting from this solicitation, () intends, () does not intend (check applicable block) to use one or more plants or facilities located at a different address from the address of the offeror or respondent as indicated in this proposal or response to request for information.

(b) If the offeror or respondent checks "intends" in paragraph (a) of this provision, it shall insert in the following spaces the required information:

Place of Performance(Street Address, City, State, County, Zip Code)	Name and Address of Owner and Operator of the Plant or Facility if Other Than Offeror or Respondent

(End of provision)

52.219-1 SMALL BUSINESS PROGRAM REPRESENTATIONS (MAY 2004)

(a)(1) The North American Industry Classification System (NAICS) code for this acquisition is 23117.

(2) The small business size standard is 28.5 Million.

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) Representations. (1) The offeror represents as part of its offer that it () is, () is not a small business concern.

(2) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents, for general statistical purposes, that it () is, () is not a small disadvantaged business concern as defined in 13 CFR 124.1002.

(3) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it () is, () is not a women-owned small business concern.

(4) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it () is, () is not a veteran-owned small business concern.

(5) (Complete only if the offeror represented itself as a veteran-owned small business concern in paragraph (b)(4) of this provision.) The offeror represents as part of its offer that it () is, () is not a service-disabled veteran-owned small business concern.

(6) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents, as part of its offer, that--

(i) It () is, () is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material change in ownership and control, principal office, or HUBZone employee percentage has occurred since it was certified by the Small Business Administration in accordance with 13 CFR part 126; and

(ii) It () is, () is not a joint venture that complies with the requirements of 13 CFR part 126, and the representation in paragraph (b)(6)(i) of this provision is accurate for the HUBZone small business concern or concerns that are participating in the joint venture. (The offeror shall enter the name or names of the HUBZone small business concern or concerns that are participating in the joint venture:_____.) Each HUBZone small business concern participating in the joint venture shall submit a separate signed copy of the HUBZone representation.

(c) Definitions. As used in this provision--

Service-disabled veteran-owned small business concern--

(1) Means a small business concern--

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a service-disabled veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

"Small business concern," means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and the size standard in paragraph (a) of this provision.

Veteran-owned small business concern means a small business concern--

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

"Women-owned small business concern," means a small business concern --

(1) That is at least 51 percent owned by one or more women; in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) Notice.

(1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.

(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm's status as a small, HUBZone small, small disadvantaged, or women-owned small business concern in order to obtain a contract to be awarded under the preference programs established pursuant to section 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall--

(i) Be punished by imposition of fine, imprisonment, or both;

(ii) Be subject to administrative remedies, including suspension and debarment; and

(iii) Be ineligible for participation in programs conducted under the authority of the Act.

(End of provision)

52.219-22 SMALL DISADVANTAGED BUSINESS STATUS (OCT 1999)

(a) General. This provision is used to assess an offeror's small disadvantaged business status for the purpose of obtaining a benefit on this solicitation. Status as a small business and status as a small disadvantaged business for general statistical purposes is covered by the provision at FAR 52.219-1, Small Business Program Representation.

(b) Representations.

(1) General. The offeror represents, as part of its offer, that it is a small business under the size standard applicable to this acquisition; and either--

___ (i) It has received certification by the Small Business Administration as a small disadvantaged business concern consistent with 13 CFR 124, Subpart B; and

(A) No material change in disadvantaged ownership and control has occurred since its certification;

(B) Where the concern is owned by one or more disadvantaged individuals, the net worth of each individual upon whom the certification is based does not exceed \$750,000 after taking into account the applicable exclusions set forth at 13 CFR 124.104(c)(2); and

(C) It is identified, on the date of this representation, as a certified small disadvantaged business concern in the database maintained by the Small Business Administration(PRO0Net); or

___ (ii) It has submitted a completed application to the Small Business Administration or a Private Certifier to be certified as a small disadvantaged business concern in accordance with 13 CFR 124, Subpart B, and a decision on that application is pending, and that no material change in disadvantaged ownership and control has occurred since its application was submitted.

(2)___ For Joint Ventures. The offeror represents, as part of its offer, that it is a joint venture that complies with the requirements at 13 CFR 124.1002(f) and that the representation in paragraph (b)(1) of this provision is accurate for

the small disadvantaged business concern that is participating in the joint venture. [The offeror shall enter the name of the small disadvantaged business concern that is participating in the joint venture: _____.]

(c) Penalties and Remedies. Anyone who misrepresents any aspects of the disadvantaged status of a concern for the purposes of securing a contract or subcontract shall:

- (1) Be punished by imposition of a fine, imprisonment, or both;
- (2) Be subject to administrative remedies, including suspension and debarment; and
- (3) Be ineligible for participation in programs conducted under the authority of the Small Business Act.

(End of provision)

52.223-13 CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (AUG 2003)

(a) Executive Order 13148, of April 21, 2000, Greening the Government through Leadership in Environmental Management, requires submission of this certification as a prerequisite for contract award.

(b) By signing this offer, the offeror certifies that--

(1) As the owner or operator of facilities that will be used in the performance of this contract that are subject to the filing and reporting requirements described in section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023) and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106), the offeror will file and continue to file for such facilities for the life of the contract the Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of EPCRA and section 6607 of PPA; or

(2) None of its owned or operated facilities to be used in the performance of this contract is subject to the Form R filing and reporting requirements because each such facility is exempt for at least one of the following reasons: (Check each block that is applicable.)

() (i) The facility does not manufacture, process, or otherwise use any toxic chemicals listed in 40 CFR 372.65;

() (ii) The facility does not have 10 or more full-time employees as specified in section 313.(b)(1)(A) of EPCRA 42 U.S.C. 11023(b)(1)(A);

() (iii) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

() (iv) The facility does not fall within the following Standard Industrial Classification (SIC) codes or their corresponding North American Industry Classification System sectors:

(A) Major group code 10 (except 1011, 1081, and 1094.

(B) Major group code 12 (except 1241).

(C) Major group codes 20 through 39.

(D) Industry code 4911, 4931, or 4939 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce).

(E) Industry code 4953 (limited to facilities regulated under the Resource Conservation and Recovery Act, Subtitle C (42 U.S.C. 6921, et seq.), 5169, 5171, or 7389 (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis); or

() (v) The facility is not located within the United States or its outlying areas.

(End of clause)

52.226-2 HISTORICALLY BLACK COLLEGE OR UNIVERSITY AND MINORITY INSTITUTION REPRESENTATION (MAY 2001)

(a) Definitions. As used in this provision--

Historically black college or university means an institution determined by the Secretary of Education to meet the requirements of 34 CFR 608.2. For the Department of Defense, the National Aeronautics and Space Administration, and the Coast Guard, the term also includes any nonprofit research institution that was an integral part of such a college or university before November 14, 1986.

Minority institution means an institution of higher education meeting the requirements of Section 1046(3) of the Higher Education Act of 1965 (20 U.S.C. 1067k, including a Hispanic-serving institution of higher education, as defined in Section 316(b)(1) of the Act (20 U.S.C. 1101a)).

(b) Representation. The offeror represents that it--

() is () is not a historically black college or university;

() is () is not a minority institution.

(End of provision)

252.247-7022 REPRESENTATION OF EXTENT OF TRANSPORTATION BY SEA (AUG 1992)

(a) The Offeror shall indicate by checking the appropriate blank in paragraph (b) of this provision whether transportation of supplies by sea is anticipated under the resultant contract. The term supplies is defined in the Transportation of Supplies by Sea clause of this solicitation.

(b) Representation. The Offeror represents that it:

____ (1) Does anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

____ (2) Does not anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

(c) Any contract resulting from this solicitation will include the Transportation of Supplies by Sea clause. If the Offeror represents that it will not use ocean transportation, the resulting contract will also include the Defense FAR Supplement clause at 252.247-7024, Notification of Transportation of Supplies by Sea.

(End of provision)

Section 00700 - Contract Clauses

CLAUSES INCORPORATED BY REFERENCE

52.202-1	Definitions	JUL 2004
52.203-3	Gratuities	APR 1984
52.203-5	Covenant Against Contingent Fees	APR 1984
52.203-7	Anti-Kickback Procedures	JUL 1995
52.203-8	Cancellation, Rescission, and Recovery of Funds for Illegal or Improper Activity	JAN 1997
52.203-10	Price Or Fee Adjustment For Illegal Or Improper Activity	JAN 1997
52.203-12	Limitation On Payments To Influence Certain Federal Transactions	JUN 2003
52.204-4	Printed or Copied Double-Sided on Recycled Paper	AUG 2000
52.209-6	Protecting the Government's Interest When Subcontracting With Contractors Debarred, Suspended, or Proposed for Debarment	JUL 1995
52.211-13	Time Extensions	SEP 2000
52.211-18	Variation in Estimated Quantity	APR 1984
52.214-3	Amendments To Invitations For Bids	DEC 1989
52.214-4	False Statements In Bids	APR 1984
52.214-5	Submission Of Bids	MAR 1997
52.214-6	Explanation To Prospective Bidders	APR 1984
52.214-7	Late Submissions, Modifications, and Withdrawals of Bids	NOV 1999
52.214-10	Contract Award--Sealed Bidding	JUL 1990
52.214-12	Preparation Of Bids	APR 1984
52.214-14	Place Of Performance--Sealed Bidding	APR 1985
52.214-15	Period For Acceptance Of Bids	APR 1984
52.214-18	Preparation of Bids-Construction	APR 1984
52.214-19	Contract Award-Sealed Bidding-Construction	AUG 1996
52.214-26	Audit and Records--Sealed Bidding	OCT 1997
52.214-27	Price Reduction for Defective Cost or Pricing Data - Modifications - Sealed Bidding	OCT 1997
52.214-28	Subcontracting Cost Or Pricing Data--Modifications--Sealed Bidding	OCT 1997
52.214-29	Order Of Precedence--Sealed Bidding	JAN 1986
52.214-34	Submission Of Offers In The English Language	APR 1991
52.215-21	Requirements for Cost or Pricing Data or Information Other Than Cost or Pricing Data--Modifications	OCT 1997
52.223-5	Pollution Prevention and Right-to-Know Information	AUG 2003
52.223-14	Toxic Chemical Release Reporting	AUG 2003
52.225-13	Restrictions on Certain Foreign Purchases	DEC 2003
52.226-1	Utilization Of Indian Organizations And Indian-Owned Economic Enterprises	JUN 2000
52.228-1	Bid Guarantee	SEP 1996
52.228-4	Workers' Compensation and War-Hazard Insurance Overseas	APR 1984
52.228-5	Insurance - Work On A Government Installation	JAN 1997
52.228-11	Pledges Of Assets	FEB 1992
52.228-14	Irrevocable Letter of Credit	DEC 1999
52.229-6	Taxes--Foreign Fixed-Price Contracts	JUN 2003
52.232-5	Payments under Fixed-Price Construction Contracts	SEP 2002
52.232-17	Interest	JUN 1996
52.232-23 Alt I	Assignment of Claims (Jan 1986) - Alternate I	APR 1984
52.232-27	Prompt Payment for Construction Contracts	OCT 2003

52.232-33	Payment by Electronic Funds Transfer--Central Contractor Registration	OCT 2003
52.233-1	Disputes	JUL 2002
52.233-3	Protest After Award	AUG 1996
52.236-2	Differing Site Conditions	APR 1984
52.236-3	Site Investigation and Conditions Affecting the Work	APR 1984
52.236-5	Material and Workmanship	APR 1984
52.236-6	Superintendence by the Contractor	APR 1984
52.236-7	Permits and Responsibilities	NOV 1991
52.236-8	Other Contracts	APR 1984
52.236-9	Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements	APR 1984
52.236-10	Operations and Storage Areas	APR 1984
52.236-11	Use and Possession Prior to Completion	APR 1984
52.236-12	Cleaning Up	APR 1984
52.236-13	Accident Prevention	NOV 1991
52.236-14	Availability and Use of Utility Services	APR 1984
52.236-15	Schedules for Construction Contracts	APR 1984
52.236-17	Layout of Work	APR 1984
52.236-21	Specifications and Drawings for Construction	FEB 1997
52.236-26	Preconstruction Conference	FEB 1995
52.242-13	Bankruptcy	JUL 1995
52.242-14	Suspension of Work	APR 1984
52.242-16	Stop-Work Order--Facilities	AUG 1989
52.243-1 Alt III	Changes--Fixed Price (Aug 1987) - Alternate III	APR 1984
52.243-4	Changes	AUG 1987
52.244-6	Subcontracts for Commercial Items	JUL 2004
52.245-4	Government-Furnished Property (Short Form)	JUN 2003
52.245-8 Dev	Liability for the Facilities Deviation	JAN 1997
52.245-9	Use And Charges	APR 1984
52.245-11	Government Property (Facilities Use)	APR 1984
52.246-12	Inspection of Construction	AUG 1996
52.247-34	F.O.B. Destination	NOV 1991
52.247-55	F.O.B. Point For Delivery Of Government-Furnished Property	JUN 2003
52.249-10	Default (Fixed-Price Construction)	APR 1984
52.249-13	Failure To Perform	APR 1984
52.249-14	Excusable Delays	APR 1984
52.253-1	Computer Generated Forms	JAN 1991
252.203-7001	Prohibition On Persons Convicted of Fraud or Other Defense-Contract-Related Felonies	MAR 1999
252.204-7003	Control Of Government Personnel Work Product	APR 1992
252.204-7004 Alt A	Required Central Contractor Registration Alternate A	NOV 2003
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252.247-7023	Transportation of Supplies by Sea	MAY 2002
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CLAUSES INCORPORATED BY FULL TEXT

52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984)

The Contractor shall be required to (a) commence work under this contract within **10** calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 720 calendar days after receipt of the notice to proceed. * The time stated for completion shall include final cleanup of the premises.

*The Contracting Officer shall specify either a number of days after the date the contractor receives the notice to proceed, or a calendar date.

(End of clause)

52.211-12 LIQUIDATED DAMAGES--CONSTRUCTION (SEP 2000)

(a) If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of \$608.00 [Contracting Officer insert amount] for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the

Termination clause.

(End of clause)

52.236-1 PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984)

The Contractor shall perform on the site, and with its own organization, work equivalent to at least 20 percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

(End of clause)

52.246-10 INSPECTION OF FACILITIES (APR 1984)

(a) Definition. "Contractor's managerial personnel," as used in this clause, is defined in the Liability for the Facilities clause of this contract.

(b) The Contractor shall provide and maintain an inspection system acceptable to the Government covering the facilities and work called for by this contract. Complete records of all inspection work performed by the Contractor shall be maintained and made available to the Government during contract performance and for as long afterwards as the contract requires.

(c) The Government has the right to inspect and test the facilities and work called for by the contract, to the extent practicable at all places and times, including the period of manufacture. The Government may also inspect the facilities and work at the plant or plants of the Contractor or its subcontractors engaged in the performance of the contract. The Government shall perform inspections and tests in a manner that will not unduly delay the work to be performed by the Contractor under this contract or any related contract.

(d) If the Government performs inspection or test on the premises of the Contractor or a subcontractor, the Contractor shall furnish and shall require subcontractors to furnish all reasonable facilities and assistance for the safe and convenient performance of these duties.

(e) The Contracting Officer may, at any time, require the Contractor to correct or replace facilities or work that is defective or does not conform to contract requirements. Except as provided in paragraph (f) below, corrections and replacements shall be at Government expense if, under the terms of this contract, the facilities or work corrected or replaced were initially furnished, or required to be performed at Government expense.

(f) The Contracting Officer may, at any time, require the Contractor to correct or replace facilities or work that is defective or does not conform to contract requirements, without cost to the Government under this contract or any related contract or subcontract, if the defects or failures are due to fraud, lack of good faith, or willful misconduct on the part of the Contractor's managerial personnel; or to the conduct of one or more of the Contractor's employees selected or retained by the Contractor after any of the Contractor's managerial personnel has reasonable grounds to believe that the employee is habitually careless or unqualified.

(i) Corrected or replacement facilities or work shall be subject to this clause in the same manner as facilities or work originally completed under the contract.

(End of clause)

52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

www.arnet.gov/far

<http://farsite.hill.af.mil>

<http://www.dtic.mil/dfars>

(End of clause)

52.252-6 AUTHORIZED DEVIATIONS IN CLAUSES (APR 1984)

(a) The use in this solicitation or contract of any Federal Acquisition Regulation (48 CFR Chapter 1) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the date of the clause.

(b) The use in this solicitation or contract of any Federal Acquisition Regulation (48 CFR 1) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the name of the regulation.

(End of clause)

252.225-7045 BALANCE OF PAYMENTS PROGRAM--CONSTRUCTION MATERIAL UNDER TRADE AGREEMENTS (JUN 2004)

(a) Definitions. As used in this clause—

“Component” means any article, material, or supply incorporated directly into construction material.

“Construction material” means an article, material, or supply brought to the construction site by the Contractor or a subcontractor for incorporation into the building or work. The term also includes an item brought to the site preassembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, that are discrete systems incorporated into a public building or work and that are produced as complete systems, are evaluated as a single and distinct construction material regardless of when or how the individual parts or components of those systems are delivered to the construction site. Materials purchased directly by the Government are supplies, not construction material.

“Cost of components” means--

(1) For components purchased by the Contractor, the acquisition cost, including transportation costs to the place of incorporation into the end product (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or

(2) For components manufactured by the Contractor, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1) of this definition, plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the end product.

“Designated country” means any of the following countries:

Aruba
Austria
Bangladesh
Belgium
Benin
Bhutan
Botswana
Burkina Faso
Burundi
Canada
Cape Verde
Central African Republic
Chad
Comoros
Cyprus
Czech Republic
Denmark
Djibouti
Equatorial Guinea
Estonia
Finland
France
Gambia
Germany
Greece
Guinea
Guinea-Bissau
Haiti
Hong Kong
Hungary
Iceland
Ireland
Israel
Italy
Japan
Kiribati
Korea, Republic of
Latvia
Lesotho
Liechtenstein
Lithuania
Luxembourg
Malawi
Maldives
Mali
Malta
Mozambique
Nepal
Netherlands
Niger
Norway
Poland
Portugal
Rwanda
Sao Tome and Principe
Sierra Leone

Singapore
Slovak Republic
Slovenia
Somalia
Spain
Sweden
Switzerland
Tanzania U.R.
Togo
Tuvalu
Uganda
United Kingdom
Vanuatu
Western Samoa
Yemen

“Designated country construction material” means a construction material that--

- (1) Is wholly the growth, product, or manufacture of a designated country; or
- (2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a designated country into a new and different construction material distinct from the material from which it was transformed.

“Domestic construction material” means--

- (1) An unmanufactured construction material mined or produced in the United States; or
 - (2) A construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind for which nonavailability determinations have been made are treated as domestic.
- “Free Trade Agreement country” means Canada, Chile, Mexico, or Singapore.

“Free Trade Agreement country construction material” means a construction material that--

- (1) Is wholly the growth, product, or manufacture of a Free Trade Agreement country; or
 - (2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a Free Trade Agreement country into a new and different construction material distinct from the material from which it was transformed.
- (b) This clause implements the Balance of Payments Program by providing a preference for domestic construction material. In addition, the Contracting Officer has determined that the Trade Agreements Act and Free Trade Agreements apply to this acquisition. Therefore, the Balance of Payments Program restrictions are waived for designated country and Free Trade Agreement country construction materials.
- (c) The Contractor shall use only domestic, designated country, or Free Trade Agreement country construction material in performing this contract, except for--

(1) Construction material valued at or below the simplified acquisition threshold in part 2 of the Federal Acquisition Regulation; or

(2) The construction material or components listed by the Government as follows:

(Contracting Officer to list applicable excepted materials or indicate “none”.)

(d) United States law will apply to resolve any claim of breach of this contract.

(End of clause)

SECTION 800

Dormitory Replacement, Thule Air Base,
Greenland

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SPECIAL CONTRACT REQUIREMENTS

1. COMMENCEMENTS, PROSECUTION AND COMPLETION OF WORK

a. The Contractor shall be required to (i) commence work under this contract within ten (10) calendar days after the date the Contractor receives the notice to proceed, (ii) prosecute the work diligently, and (iii) complete the entire work ready for use not later than 720 (See bid schedule for optional duration) calendar days after the date the Contractor receives the Notice To Proceed. The time stated for completion shall include the final cleanup of the premises. FAR 52.212-3 (APR 1984)

b. Location: The site of work is located at Thule AB, Greenland. The site of the work is on a military installation and all rules and regulations issued by the Commanding Officer covering general safety, security, and sanitary requirements, etc., shall be observed by the Contractor.

(1) Thule Air Base is remotely located. The site of work is located north of First Street and south of Building 98 and currently occupies Building 103. First Street contains the site to the south, Building 105 to the west by and to the north by the existing aboveground utilities between Building 98 and the current location of Building 103. The site of the work is on a military reservation and all rules and regulations issued by the Commanding Officer covering general safety, security, and sanitary requirements, etc., shall be observed by the Contractor. Access to and from is restricted to limited air service and an annual sealift. Transport requirements are presented in Section 00800, paragraph 41.

(2) The annual military sea transportation service operation is limited to a 60-day period, normally the second week of July through the first week of September.

(3) It is a requirement of this contract that the contractor or his representative must arrive at Thule AB at least 10 calendar days in advance of the arrival of equipment, materials or laborers. The Contractor and the Contracting Officer (or Contracting Officer Representative) will review the Contractor's CPM schedule project logistics, and Thule AB regulations.

(4) Holidays observed at Thule AB by USAF and GC:

- 01 January (New Year's Day)
- Third Monday in January (Birthday of Martin Luther King Jr.)
- Third Monday in February (President's Day)
- Last Monday in May (Memorial Day)
- 04 July (Independence Day)
- First Monday in September (Labor Day)

- Second Monday in October (Columbus Day)
- 11 November (Veteran's Day)
- Fourth Thursday in November (Thanksgiving Day)
- 25 December (Christmas Day)

Holidays which fall on the weekends are normally observed on the following Monday. Danish holidays are not observed at Thule AB. Holidays which fall on a Saturday will normally be observed by GC that same day, but by USAF the following Monday.

c. The Contractor shall furnish all labor, materials, equipment and services (except those furnished by the Government) for the following work: Provide a new 72 Room Dormitory and all affiliated work described herein and in the accompanying specification and drawings.

d. All work shall be done in accordance with the drawings and specifications or instructions attached hereto and made a part thereof, or to be furnished hereafter by the Contracting Officer and subject, in every detail, to his supervision, direction, and instructions. (DOD FAR supplement 52.236-7014).

e. Magnitude of construction Project: The estimated value of the proposed work is over \$10,000,000.00.

f. The work under this contract may be severely influenced by inherent geographical and climatic constraints. Access to Thule for materials, equipment, and personnel is limited to an annual sealift. Military airlift may be available, depending on the availability of cargo space, but is very costly and at the Contractor's expense. The annual Military Sea Transportation Service operation is limited to summer months only. Due to total daylight at Thule during this period, the Contractor can schedule continuous construction work. Acquisition of building materials at airlift is normally restricted to personnel and critical equipment only.

2. LIQUIDATED DAMAGES - CONSTRUCTION: (APR 1984) (FAR 52.212-5)

a. If the Contractor fails to complete the work within the time specified in the contract, or any extension, the Contractor shall pay to the Government as liquidated damages, the sum of **\$608.00** for each day of delay.

b. If the Government terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the Government in completing the work.

c. If the Government does not terminate the Contractor's right

to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

d. At a time the project is physically complete but is functionally complete to the satisfaction of the Government, the Government at its sole discretion may accept transfer of the facility or project provided that the remaining work to be done "punchlist" is completed no later than 30 days from the date of transfer. In this case the contractor shall pay a liquidated damages for punchlist items not completed in the daily amount of \$127.00 per day commencing after 30 days of project transfer or after date required for project completion (including all extensions), whichever occurs later.

3. EQUAL OPPORTUNITY PREAWARD CLEARANCE OF SUBCONTRACTS (1984 APR)

Notwithstanding the clause of this contract entitled "Subcontracts", the Contractor shall not enter into a first-tier subcontract for an estimated or actual amount of \$1 million or more without obtaining in writing from the Contracting Officer a clearance that the proposed subcontractor is in compliance with the equal opportunity requirements and therefore is eligible for award. (FAR 52.222-28)

4. INSURANCE - WORK ON A GOVERNMENT INSTALLATION (APR 1984)

a. The Contractor shall procure and maintain during the entire period of his performance under this contract the following minimum insurance:

- (1) General Liability Insurance (comprehensive form of policy):

Bodily injury liability - \$500,000 per occurrence.

- (2) Automobile Liability Insurance (comprehensive form of policy):

Bodily Injury Liability - \$200,000 per person and \$500,000 Per Accident.

Property Damage Liability - \$20,000 per accident.

(3) Workmen's Compensation and Employer's Liability Insurance: Compliance with applicable workmen's compensation and occupational disease statutes is required. Employers' liability coverage in the minimum amount of \$100,000 is also required.

b. Prior to the commencement of work hereunder, the Contractor shall furnish to the Contracting Officer a certificate or statement of the above required insurance. The policies evidencing required insurance shall contain an endorsement to the effect that cancellation or any material change in the policies adversely affecting the interests of the Government in such insurance shall not be effective for such

period as may be prescribed by the laws of the State in which this contract is to be performed and in no event less than thirty (30) days after written notice thereof to the Contracting Officer.

c. The Contractor agrees to insert the substances of this clause, including this paragraph c., in all subcontracts hereunder.
(FAR-52.228-5)

5. PERFORMANCE OF WORK BY THE CONTRACTOR: (1984 APR)

The Contractor shall perform on the site, and with its own organization, work equivalent to at least twenty (20) percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government. (FAR 52.236-1)

6. WARRANTY OF CONSTRUCTION: (APR 1984)

a. a.

In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph (j) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

b. b.

This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

c. The

Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of:

(1) The Contractor's failure to conform to contract requirements,
or;

(2) Any defect of equipment, material, workmanship, or design furnished.

d. Th

e Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

e. The Contracting officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.

f. If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

g. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall:

(1) Obtain all warranties that would be given in normal commercial practices:

(2) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting officer; and

(3) Enforce all warranties for the benefit of the Government, if directed by the Contracting officer.

h. In the event the Contractor's warranty under paragraph (b) of this clause has expired, the Government may bring suit at its expense to enforce a sub-contractor's, manufacturer's, or supplier's warranty.

i. Unless a defect is caused by the negligence of the Contractor or sub-contractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from the defect in Government-furnished material or design.

j. This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud. (FAR 52.246-21)

7. **CERTIFICATES OF COMPLIANCE**

Any certificates required for demonstrating proof of compliance of materials with specification requirements shall be executed in 4 copies. Each certificate shall be signed by an official authorized to certify in behalf of the manufacturing company and shall contain the name and address -of the Contractor, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Contractor from furnishing satisfactory material, if, after tests are performed on selected samples, the material is found not to meet the specific requirements. (ECI 7-670.3)

8. **IMPLEMENTING GUARANTEES**

At any time subsequent to the acceptance by the Government of a completed installation under this contract, which installation is required to be covered by a specific guarantee under the terms of the various sections in the TECHNICAL PROVISIONS, the Base Commander will be an authorized party for the purpose-of implementing the provisions of such guarantees in behalf of the Government.

9. **BID BOND** (MAR 1989) See Bid Bond Clause of Contract Clauses.

10. **CONTRACT DRAWINGS, MAPS AND SPECIFICATIONS** (52.236-7002)

The below listed drawings are herein attached to this specification. Also, see contract clause entitled CONTRACT DRAWINGS, MAPS AND SPECIFICATIONS in Section 00700 CONTRACT CLAUSES.

SHEET NUMBER	SHEET REF. NUMBER	SHEET TITLE	NYCOE DRAWING FILE NUMBER
1	G-001	COVER SHEET AND DRAWING INDEX	8008-11000
2	G-002	VICINITY MAP, LOCATION	8008-11001
3	G-003	LIFE SAFETY PLAN (FOR INFORMATION ONLY)	8008-11002
4	C-100	EXISTING CONDITIONS	8008-11003
5	C-101	DEMOLITION SITE PLAN	8008-11004
6	C-102	NEW SITE GRADING PLAN	8008-11005
7	C-103	UTILITY SITE PLAN	8008-11006
8	C-104	UTILITY SERVICE PROFILE	8008-11007
9	C-105	INSULATION/NFS FILL PROFILES ENLARGED UTILITY PLAN	8008-11008
10	C-501	UTILITY SITE DETAILS	8008-11009
11	C-502	UTILITY SITE DETAILS	8008-11010
12	C-503	ELECTRICAL SITE DETAILS	8008-11011
13	C-504	UTILITY DETAILS	8008-11012

14	C-505	UTILITY DETAILS	8008-11013
15	B-601	BORING LOGS	8008-11014
16	L-101	LANDSCAPE SITE PLAN	8008-11015
17	L-501	LANDSCAPE DETAILS	8008-11016
18	H-101	ENVIRONMENTAL DEMOLITION PLAN - BUILDING 103	8008-11017
19	AD101	DEMOLITION PLAN - BUILDING 103	8008-11018
20	AD102	DEMOLITION PHOTOS - BUILDING 103	8008-11019
21	A-101	FIRST FLOOR PLAN	8008-11020
22	A-102	SECOND FLOOR PLAN	8008-11021
23	A-103	THIRD FLOOR PLAN	8008-11022
24	A-104	REFLECTED CLEAR AIR SPACE PLAN	8008-11023
25	A-105	FIRST FLOOR REFLECTED CEILING PLAN	8008-11024
26	A-106	SECOND FLOOR REFLECTED CEILING PLAN	8008-11025
27	A-107	THIRD FLOOR REFLECTED CEILING PLAN	8008-11026
28	A-108	ROOF PLAN	8008-11027
29	A-201	EXTERIOR ELEVATIONS	8008-11028
30	A-202	EXTERIOR ELEVATIONS	8008-11029
31	A-203	EXTERIOR COLOR KEY ELEVATIONS	8008-11030
32	A-301	BUILDING SECTIONS	8008-11031
33	A-302	BUILDING SECTIONS	8008-11032
34	A-303	BUILDING SECTIONS	8008-11033
35	A-304	BUILDING SECTIONS	8008-11034
36	A-305	BUILDING SECTIONS	8008-11035
37	A-401	ENLARGED UNIT PLANS	8008-11036
38	A-402	ENLARGED REFLECTED CEILING PLAN	8008-11037
39	A-403	ENLARGED COMMON AREA PLAN	8008-11038
40	A-404	ENLARGED STAIR PLANS	8008-11039
41	A-405	ENLARGED MODULE PLANS, OPTIONAL BID ITEM No. 1,2,3 AND 4	8008-11040
42	A-501	WALL SECTIONS	8008-11041
43	A-502	WALL SECTIONS	8008-11042
44	A-503	WALL SECTIONS	8008-11043
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130	FA103	FIRE ALARM AND MASS NOTIFICATION THIRD FLOOR PLAN	8008-11129
131	FA104	FIRE ALARM ATTIC PLAN	8008-11130

11. RECORD DRAWINGS

a. General: The Contractor will maintain as-built drawings during the construction period and will submit final record drawings at the completion of individual facilities. The Government will provide to the Contractor the CAD (Computer-Aided Drafting) files consisting of compact (computer) disks or magnetic media of the drawing files in the **AutoCAD** format for the project. The Contractor is required to make prints or Mylars from the CAD files and continuously maintain drawings to show current as-built conditions for the duration of the construction. Except for updates as indicated below, the Contractor may maintain as-built drawings by marking up drawings by hand or by CAD methods. Scanned drawings will not be acceptable. If the Government cannot provide CAD files for the project drawings, Mylar (reproducible) drawings will be provided. The contractor will then be required to comply with all requirements indicated herein by the use of hand drafting.

b. Progress As-built Prints: During construction the Contractor is responsible for maintaining up to date one set of paper prints to show as-built construction conditions. These prints shall be kept current and available on the job site at all times. All changes from the contract plans, which are made in the work, or additional information, which might be uncovered in the course of construction, shall be accordingly and neatly recorded as they occur by means of details and notes. The as-built prints will be jointly inspected for accuracy and completeness by the Contracting Officer's Representative and a responsible representative of the Contractor prior to submission of each monthly pay estimate. Partial payment will be withheld (amount to be determined) if the monthly review of as-built drawings reveals inaccuracies or incompleteness of as-built conditions. Progress as-builts shall show the following information, but not limited thereto:

(1) The location and description of any utility lines, valves, or other installations of any kind within the construction area. The location includes dimensions to permanent features. Average depth below surface shall also be indicated. The location of all underground utility lines, valve boxes or other items shall be located using a minimum of two tie-point dimensions. All dimensions must be taken from permanent structures or points that will remain after the construction work is completed.

(2) The location and dimensions of any changes with the building and structure.

(3) Correct grade or alignment of roads, structures or utilities if any changes were made from the contract plans.

(4) Correct elevations if changes were made in site grading.

(5) Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor including but not limited to fabricated,

erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

(6) The topography and grades of all drainage installed or affected as part of the project construction.

(7) All changes, which result from contract modifications.

(8) Where contract drawings or specifications allow options, only the option selected for construction shall be shown on the as-built prints.

(9) Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler and irrigation systems.

(10) All amendments to the contract drawings issued during the solicitation period shall be posted on the as-built drawings.

c. Hand Drafting: If Mylars only are provided to the Contractor, they shall be updated using hand drafting. Only personnel proficient in the preparation of engineering drawings to standards satisfactory and acceptable to the Government shall be employed to modify the Mylar reproduction drawings or prepare additional new drawings. All additions and corrections to the contract drawings shall be neat, clean and legible, and shall match the adjacent line work and/or lettering being annotated in type, density, size and style. All drafting work shall be done using the same medium (pencil, plastic lead or ink) that was employed on the original contract drawings and with graphic lead on paper base material. The title block to be used for any new as-built drawings shall be similar to that used on the original contract drawings.

d. Protection of Records: The Contractor shall be responsible for the protection and safety of Mylars and CAD record until returned to the Contracting Officer. Any drawings damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at his expense.

e. 50% As-Built Update: At the 50% point in construction of this project (as determined by progress payments) the Contractor will update the CAD files of the project drawings in the appropriate CAD program to show as-built conditions as above, and submit an updated computer disk and one set of prints to the Contracting Officer for approval. If Mylars only are provided to the Contractor, they shall be updated at this stage using hand drafting as specified herein, and the Contractor shall submit one set of prints to the Contracting Officer for approval. The Contractor shall make any required corrections before payment will be approved for this item. The Contractor must use the updated CAD record or Mylar drawings to produce required prints.

f. Preliminary Record Drawing Submittal: At least thirty calendar (30) days before the anticipated date of final acceptance inspection the Contractor shall deliver two copies of

progress prints showing final as-built conditions to the Contracting Officer for review and approval. These prints shall correctly show all the features of the project as it has been constructed, adding such additional drawings as may be necessary. They shall be printed from the CAD files updated in the appropriate CAD program, or from updated Mylars if Mylars only were provided to the Contractor. Within ten days, the Government will provide the Contractor one set of prints indicating required corrections to the preliminary submittal. Contractor will correct and resubmit within 5 days. Any required subsequent review and resubmission periods will each be accomplished within 5 days. Upon Government approval of the preliminary submittal, the Contractor will prepare final record drawings.

g. Record Drawing Submission: In the appropriate CAD program each drawing shall be marked with the words "RECORD DRAWING AS-BUILT" followed by the name of the Contractor in font which will print at least 3/16" high. All revisions to the original contract drawings will be dated in the revision block. All prints and Mylars must be reproduced from the updated CAD files. If Mylars only were provided to the Contractor, they shall be hand-lettered or stamped as indicated above, and revisions shown in revision block. A minimum of 5 calendar days before the anticipated date of final acceptance inspection of the project the Contractor shall deliver to the Contracting Officer:

Three (3) CD's (ROM) of CAD files of Record Drawings;
One (1) set of Mylar Record Drawings, and;
One (1) copy of prints of Record Drawings.

Failure to make an acceptable submission of Record Drawings will delay the Final Acceptance Inspection for the project and shall be cause for withholding any payment due the Contractor under this contract.

h. Property: All paper prints, reproducible drawings and CAD files will become property of the Government upon final approval. Approval and acceptance of the final record drawings shall be accomplished before final payment is made to the Contractor.

i. Payment: An item entitled "Final Record Drawing Submission" occurs in the Bid/Proposal Schedule for work/deliverable under this contract. The Contracting Officer has established the amount shown in the Bid Schedule for this work/item. This item becomes a part of the overall Contractor's price, but payment shall be withheld until the "Final Record Drawing Submission" have been approved and accepted by the Contracting Officer.

12. DESIGNATION OF PROPERTY ADMINISTRATOR

The Chief, Property and Accounting Section, US Army Engineer District, New York, Jacob K. Javits Federal Building, 26 Federal Plaza, New York, N.Y. 10278-0090 is designated as Property Administrator in connection with this contract.

13. PHYSICAL DATA

Information and data furnished or referred to below are furnished for the Contractor's information. However, it is expressly understood that the Government will not be responsible for any interpretation or conclusion drawn there from by the Contractor. (FAR 52.236-4) (APR 1984)

a.

G

Geographic Conditions:

Thule Air Base is located above the Arctic Circle on the western coast of Greenland. The entire region has been glaciated and the existing soil is generally permafrost, which exists from 1 to 6 feet below the surface and to a measured depth of 1,600 feet.

b.

Weather Conditions: Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor. Weather and storm conditions are listed in the project specifications. Contractor shall take into consideration the typical weather conditions depicted therein in planning the work to be performed under this contract. Typically, exterior work (or work outside) may commence on or about 15 June and continue through 15 September; give or take a few weeks. Contractors shall take this into consideration in planning the work even though the contract may allow a performance period well into October.

(1) Average winter temperature is 20 to 30 degrees F below zero while average summer temperature is 40 to 50 degrees F above zero. Thawing starts in early June and continues until September, when the thawed active layer of soil has its maximum thickness.

(2) The prevailing winds are westerly in the summer and easterly in the winter. Winds of 125 miles per hour, predominantly from the east, occur at infrequent intervals. Winds above 150 miles per hour have been experienced on occasional, precipitation is only 4 inches annually; however, winter "blow snow" from the glacier to the east causes some snowdrift formation.

(3) Thule has total daylight during the months of May through August and total darkness during the months of mid-November through almost the end of January. The months of February, March, April, September, October and November experience both darkness and daylight hours, though at a varied rate.

c. Construction Constraints: The Composite Medical Facility Replacement project may be severely influenced by inherent geographical and climatic conditions noted above. Access to Thule AB for personnel materials and equipment is limited to surface transportation as described in paragraph 41.

14. PRICING OF ADJUSTMENTS

When costs are a factor in any determination of a contract price adjustment pursuant to the Changes clause or any other clause of this contract, such costs shall be in accordance with Part 31 of the Federal Acquisition Regulation and DFARS 52.215-7000 (APR 1985) as follows:

In determining whether a pricing adjustment is expected to exceed \$100,000, the term "pricing adjustment" shall mean "the aggregate increases and/or decreases in cost plus applicable profits."

15. PAYMENT FOR MATERIALS DELIVERED OFF-SITE

Pursuant to the Contract Clause in this contract titled "Payments Under Fixed-Price Construction Contracts", materials delivered to the contractor at locations other than the site of the work may be taken into consideration in making payments if included in payment estimates and if all the conditions of the Contract Clauses are fulfilled. Payment for items delivered to locations other than the work site will be limited to those materials that have been approved, if required by the technical provisions, and to those materials that have been fabricated to the point where they are identifiable to an item of work required under this contract. Such payment will be made only after receipt of paid or receipted invoices or invoices with cancelled check showing title to the items in the name of the prime contractor and including the value of materials and labor incorporated into the item.

16. EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE

a. All allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data when the Government can determine both ownership and operating costs for each piece of equipment or equipment groups of similar serial and series from the contractor's accounting records. When both ownership and operating costs cannot be determined from the contractor's accounting records, equipment costs shall be based upon the applicable provisions of EP 1110-1-8, "Construction Equipment Ownership and Operating Expense Schedule." Regional. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the Contracting Officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate maybe developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retrospective pricing, the schedule in effect at the time the work was performed shall apply. (This manual can be ordered from the Government Printing office by calling telephone number (202) 783-3238. There is a charge for the manual.

b. Equipment rental costs are allowable, subject to

the provisions of FAR 31.105(d)(ii) and FAR 31.205-36 substantiated by certified copies of paid invoices. Rates for equipment rented from an organization under common control, lease-purchase or sale-leaseback arrangements will be determined using the schedule except that rental costs leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees are allowable. Costs for major repairs and overhaul are unallowable.

c. When actual equipment costs are proposed and the total amount of the pricing action is over \$25,000, cost or pricing data shall be submitted on Standard Form 1411, "Contract Pricing Proposal Cover Sheet." By submitting cost or pricing data, the Contractor grants to the Contracting Officer or an authorizing representative the right to examine those books, records, documents and other supporting data that will permit evaluation of the proposed equipment costs. After price agreement the Contractor shall certify that the equipment costs or pricing data submitted are accurate, complete and current.

17. ALTERATIONS IN CONTRACT (APR 1984)

Portions of this contract are altered as follows:

a. Add the following sentence to paragraph 11g, of Contract Clause: SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (1984 APR): "Upon completing the, work under this contract, the Contractor shall furnish a complete set of all shop drawings as finally approved. These drawings shall show all changes and revisions made up to the time the equipment is completed and accepted-" Alt. 1 (APR 1984) (FAR 52.236-21)(7-602.54(b)(1) OCT 1976)

b. In the Contract Clause title, which reads, "MODIFICATION OF PROPOSALS-" change to "MODIFICATION PROPOSALS-".

18. AVAILABILITY AND USE OF UTILITY SERVICES (APR 1984)

a. The Government shall make all reasonably required amounts of utilities available to the contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, schedule or specifications, the amount of each utility service consumed shall be free of charge to the Contractor. The contractor shall carefully conserve any utilities furnished without charge.

b. The Contractor, at his expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final

acceptance of the work by the Government, the Contractor shall remove all temporary connections, distribution lines, meters and associated paraphernalia. (FAR 52.236-14)

c.

Water:

All reasonably required amounts of water will be made available to the Contractor by the Government from such existing water system outlets and supplies, without cost to the Contractor for the water he consumes. All water shall be carefully conserved. The contractor shall, at his own expense, in a workmanlike manner satisfactory to the Contracting Officer, install and maintain any necessary water supply connections and piping required to obtain water from the existing system. All temporary lines shall be chlorinated prior to connection to existing lines.

d.

Electricity:

All reasonably required amounts of electric power will be made available to the Contractor by the Government from Government owned or operated electrical systems and supplied without cost to the Contractor. The Contractor shall install and maintain at his own expense any necessary supply connections and facilities but only at such locations and in such workmanlike manner as may be authorized by the Contracting officer. All electricity shall be carefully conserved. Before final acceptance temporary connections and facilities installed by the Contractor shall be removed in a workmanlike manner to the satisfaction of the Contracting Officer. If, for any reason, the Government is unable to furnish all reasonable amount of electric power required by the Contractor in the performance of this contract, it shall be the responsibility of the Contractor to provide an adequate supply of electric power at his own expense, subject to reimbursement by the Government on an actual cost basis.

19. Not Used.

20. **SALVAGE MATERIALS AND EQUIPMENT**

The Contractor shall maintain adequate property control records for all materials or equipment specified to be salvaged. These records may be in accordance with the Contractor's system of property control, if approved by the property administrator. The Contractor shall be responsible for the adequate storage and protection of all salvaged materials and equipment and shall replace, at no cost to the Government, all salvage materials and equipment which are broken or damaged during salvage operations as the result of his negligence, or while in his care. (DOD FAR Supplement 52.236-7005)

21. **IDENTIFICATION OF GOVERNMENT-FURNISHED PROPERTY (APR 1984)**

a. The Government will furnish to the Contractor the property identified in paragraph B. The property will be delivered at the project site. When the property is delivered, the Contractor shall verify its quantity and condition and acknowledge receipt in writing to the Contracting Officer. The Contractor shall also report in writing to the Contracting officer within 72 hours of delivery any

damage to or shortage of the property as received. All such property shall be installed or incorporated into the work at the expense of the Contractor, unless otherwise indicated in this contract.

b. Each item of property to be furnished under this clause shall be identified in the Schedule by Quantity, item and description.
(FAR-52.245-3)

Item No.	Description	Quantity
1.	POL Products	Arctic Diesel Fuel Mogas Lubricant Oil SAE 10W30 Gear oil Hydraulic oil HDO, 10 & 30 Antifreeze
2.	Arctic Parkas	One per person. See paragraph 48 of this section
3.	Arctic Gear, other than parkas	Provided by Contractor. See Paragraph 48 of this section.
4.	Aggregate for concrete work	Provide by Contractor

22. CONSTRUCTION PROJECT SIGNS

The contractor shall construct two signs: one for project identification, and the other to show on-the-job safety performance.

Sample sign drawings are provided at the end of this section. The signs shall be erected as soon as possible and within 15 calendar days after the date of the Notice to Proceed.

The two signs are to be displayed side by side and mounted for reading by passing viewers. The Contracting Officer will designate exact placement/location.

Panels are fabricated using HDO (High Density Overlay) plywood with dimensional lumber uprights and bracing. The sign faces are non-reflective vinyl.

All legends are to be die-cut or computer-cut in the sizes and type-faces specified and applied to the white panel background following the graphic formats shown on the attached sheets. The Communications Red panel on the left side of the construction project signs with the Corps signature (reverse version) is screen printed onto the white background.

No separate payment will be made for erecting and maintaining the signs and all costs in connection therewith will be considered the obligation of the Contractor. Upon completion of the project, the Contractor shall remove the signs from the work area.

23. TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

Time extensions will be granted for any time above the annual average of 10 days lost due to "Storm 2" or "Storm 3" weather conditions. The Base Command declares storm conditions as they occur. When a Storm 2 condition is declared all non-essential work is discontinued and personnel return to their quarters. Upon return to quarters, personnel report their location to the "storm" coordinator. When a Storm 3 condition is declared all personnel are restricted to the building in which they are located. All Contractor personnel are considered to be engaged in non-essential work with regard to these storm conditions unless otherwise categorized by the Contracting officer.

24. SCHEDULING AND DETERMINATION OF PROGRESS

Pursuant to the contract clause, SCHEDULES FOR CONSTRUCTION CONTRACTS, the Contractor shall prepare and submit for approval a practicable project schedule. The type of schedule and detailed requirements as well as timing of this submittal shall be as specified in specification section "Project Schedule".

This schedule will be the medium through which the timeliness of the contractor's construction effort is appraised. When changes are authorized that result in contract time extensions, contractor shall submit a modified schedule for approval by the Contracting Officer.

The terms of Contract Clause, SCHEDULES FOR CONSTRUCTION CONTRACTS, with reference to overtime, extra shifts, etc., may be invoked when the Contractor fails to start or complete work features or portions of same by the time indicated by the milestone dates on the approved project schedule or when it is apparent to the Contracting Officer from the Contractor's actual progress that these dates will not be met.

Neither on the project schedule as originally submitted nor on any submitted periodic schedules which the Contractor is required to prepare and submit, shall be actual progress to be entered include or reflect any, materials which even though on the site, are not yet installed or incorporated in the work. For payment purposes only, an allowance will be made by the Contracting Officer of up to 100 percent of the invoiced cost of materials or equipment delivered to the site but not incorporated into the construction, pursuant to Contract Clause, PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS. The making of such an allowance will be contingent upon a determination by the Contracting Officer that the Contractor's compliance with the quality control requirements of the contract is more than satisfactory.

25. IDENTIFICATION OF EMPLOYEES

The Contractor shall be responsible for furnishing to each employee and for requiring each employee engaged on the work to display such identification as may be approved and directed by the Contracting Officer. All prescribed identification shall immediately be delivered to the Contracting officer for cancellation upon the

release of any employees. When required by the Contracting Officer, the Contractor shall obtain and submit fingerprints of all persons employed or to be employed on the project. (DOD FAR Supplement 52.236-7007)

26. FIELD OFFICE

a. The Contractor shall provide the following computer and office equipment, and other items for use by the Government during the contract:

Hardware:

Personal Computer:

- Pentium IV processor running at 2.4 GHz or better
- High speed cache memory controller with at least 512 KB L2 PIPELINE BURST CACHE
- At least 512MB SDRAM
- 400MHz System Bus
- (1) 3.5" 1.44 MB diskette drives with hard drive controller
- 60 GB hard drive with access time of 9 ms
- Front and Rear USB Ports
- 3 COM 10/100MB Base T Ethernet Network Interface Card (NIC)
- Microsoft TCP/IP
- Sound Card *WI* SPEAKERS
- Enhanced 101 keyboard
- 6 outlet surge protector
- 17" LCD Flat Panel SVGA high resolution COLOR monitor with refresh rate 75Hz or better
- Diamond Viper V770D Video Card or better
- 3 Button Ergonomic Mouse and mouse pad
- Modem V.90 56KB Baud or DSL Cable Modem (Coordinate with DSL Cable Modem Service provide be the Contractor)
- Internal DVD ROM 16X and CD-RW (Read/Write) Drive 24X or better
- Microsoft Windows 2000 Professional Operating System or XP Professional Operating System
- Microsoft Office 2000 Professional Suite
- Adobe Acrobat Read/Write
- Signature card reader: Gradkell Computer Inc. Part# 050-0300 Description: Argus 300 (card reader and PCI adapter package) for CEFMS: phone# (256)-722-8585 X37 (Mr. Wayne Wright)
- Norton Antivirus Software 2002 and periodic updates.

Printer:

- Hewlett Packard LaserJet 4100 Multifunction Series Printer/Scanner/Copier or equivalent

LaserJet Printer.

DSL or Cable Modem Service: Business DSL or Cable modem service with required equipment (modems, filters, etc.). Service shall be 1.5 Mps downstream/ 384Kps upstream. Contractor shall pay all cost associated with this service including ISP fees. Contractor's field office and USACE field office shall not utilize the service line.

b. No separate payment will be made for providing the above items and all costs in connection therewith will be considered the obligation of the Contractor.

Computer Security requirements:

The contractor will agree to accept responsibilities and comply with procedures indicated below in connection with the furnishing of Contractor-owned computers for use by Government personnel in accordance with contract requirements.

a. The computers must be dedicated exclusively for Government use. Contractor will not any use any computer it supplies which is designated for use by the Government. Contractor will assure that the Central Processing Unit (CPU) is electronically isolated from the contractor's and not inter-connected via Local Area Network (LAN).

b. Normal access to the computer shall be restricted to Corps of Engineers personnel. Contractor shall set up computers in a secure area and give the keys to the Government. Contractors must immediately notify Government personnel when emergency access to the computer location is exercised by non-Government individuals, and what the circumstances were regarding the unauthorized access.

c. If the CPU hard drive fails, the Government will furnish an equivalent hard drive to the owner of the computer, and the old hard-drive will be returned to the Government. Contractor shall not remove any hard drive nor proceed with any repair of the computer unless an authorized Government employee witnesses and approves of the repair.

d. At the time of return of the computer, the Contractor will allow the Government to first remove all information from the hard-drive.

e. Contractor agrees to provide a written certification signed by an authorized officer of the company agreeing to the above policy.

27. **QUANTITY SURVEYS:** Not Used.

28. **TIME EXTENSIONS:** (APR 1984)

Not withstanding any other provisions of this contract, it is mutually understood that the time extensions for changes in the work will depend upon the extent, if any, by which the changes cause delay in the completion of the various elements of construction. The change

order granting the time extension may provide that the contract completion date will be extended only for those specific elements so delayed and that the remaining contract completion dates for all other portions of the work will not be altered and may further provide for an equitable readjustment of liquidated damages under the new completion schedule. (FAR 52.212-6)

29. **MISPLACED MATERIAL:** Not Used.

30. **SUPERINTENDENT OF SUBCONTRACTORS:** (JAN 1965)

a. The Contractor shall be required to furnish the following, in Addition, to the superintendent required by the Contract Clauses titled, "SUPERINTENDENT BY THE CONTRACTOR."

(1) If more than 50% and less than 70% of the value of the contract work is subcontracted, one superintendent shall be provided at the site and on the Contractor's payroll to be responsible for coordinating, directing, inspecting, and expediting the subcontract work.

(2) If 70% or more of the value of the work is subcontracted, the Contractor shall be required to furnish two such superintendents to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

b. If the Contracting officer, at any time after 50% of the subcontracted work has been completed, finds that satisfactory progress is being made, he may waive all or part of the above requirement for additional superintendent subject to the right of the Contracting Officer to reinstate such requirement if at any time during the progress of the remaining work he finds that satisfactory progress is not being made. (DoD FAR Supplement 52.236-7008)

31. **PROCEDURES FOR SUBMISSION AND PAYMENT OF ALL CONTRACT PAYMENTS**

In addition to the requirements contained in the Contract Clause entitled "PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS" and to implement the requirements of the Prompt Payment Act Amendments of 1988, P.L. 100-496, the following shall apply to all payments made under this contract:

a. At the time of submission of the progress chart, the Contractor shall submit for approval by the Contracting Officer or his authorized representative a breakdown of the contract work, which shall be to the degree of detail, required by the Contracting officer or his representative to effect reasonable progress payments. The Contracting Officer or his representative shall review this breakdown within 30 calendar days after receipt and either advise the Contractor that it is approved or disapproved, and if disapproved the reasons for disapproval. Only after the breakdown is approved shall any payment

invoice be accepted from the Contractor and any payment made to him. The Contracting Officer can determine it is in the best interest of the Government to make payment without an approved breakdown, however, in no case shall more than 10% of the contract amount be paid unless the breakdown is approved.

b. The Contractor shall submit his request for payment by submission of a proper invoice to the office or person(s) designated in subparagraph (c). For purposes of payment a "proper invoice" is defined as the following:

1. An estimate of the work completed in accordance with the approved breakdown indicating the percentage of work of each item and the associated costs.

2. A properly completed Eng. Form 93 and 93a (where required).

3. All contractual submissions indicated elsewhere in this contract to be submitted with payment, such as updated progress schedules, updated submittal registers, etc.

4. The following certification executed by a responsible official of the organization authorized to bind the firm. A "responsible official" would be a corporate officer, partner, or owner, in the case of a sole proprietorship.

I hereby certify, to the best of my knowledge and belief, that:

(1) The amounts requested are only for performance in accordance with the specifications, terms and conditions of the contract;

(2) Payments to subcontractors and suppliers have been made from previous payments received under the contract and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract requirements and the requirements of Chapter 39 of Title 31, United States Code, and;

(3) This request for progress payments does not include any amounts, which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract.

(4) All required prime and subcontractor payrolls have been submitted:

(Name) _____

(Title) _____

(Date) _____

c. The Government shall designate the office or person(s) who shall first receive the invoice submissions and the Contractor shall be so notified at the pre-construction conference. In addition to the designated Project Engineer, the Contractor shall at the same time submit one copy of the detailed breakdown and the Eng Form 93 and 93a Form to the Area Engineer.

d. The Government representative shall return any request for payment, which is deemed defective within 7 days of receipt and shall specify the defects. If the defect concerns a disagreement as to the amount of work performed and or the amount of the payment being submitted, the Government and the Contractor's representative should meet to resolve the differences and reach agreement. Upon agreement, the Contractor shall submit a new breakdown and Eng Form 93 (and 93a) and any other submissions requiring correction. These will be incorporated with the previous submittal and will then constitute a proper invoice.

e. If agreement cannot be reached, the Government shall determine the proper amount per Contract Clause, "PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS" and process the payment accordingly. In this event, a "proper invoice" for Prompt Payment Act purposes will not have been submitted to the Government.

f. The Government shall pay the Contractor in accordance with the following time frames:

1. Progress Payments. Fourteen days are required to afford the Government a practicable opportunity to adequately inspect the work and determine the adequacy of the Contractor's performance under the contract.

2. Reduction in Retainage Payment. If during the course of the contract, a reduction in retainage payment is required, the Government shall issue a check within 30 calendar days after the approval of the release to the Contractor by the Contracting Officer or his authorized representative.

3. Final Payment. A final payment request shall not be considered valid until the Contractor has fulfilled all contract requirements including all administrative items, payrolls, warranties, etc., and has submitted a release of claims. When the Contractor has fulfilled all contract requirements and a "proper invoice" has been submitted, the Government shall issue a check within 14 days from the date of acceptance of the project by the Contracting Officer.

32. SALE OF JOB-PRODUCED MATERIALS

The Contractor shall not sell to others or use for any purpose other than for the performance of the work under this contract any job-produced materials, in the production of which any Government-furnished equipment or property is used, without the prior written consent of the Contracting Officer except as specifically provided herein.

33. SALE OF CONTRACTOR INVENTORY

The Contractor shall obtain the written approval of the Contracting Officer prior to concluding any and all proposed sale of contractor-owned personal property at Thule Air Base to which the government has any obligation or right under the contract to purchase from the contractor, including such property which has been acquired or procured by the contractor for the performance of the work and services under this contract. In requesting approvals of proposed sales, where required under this paragraph, the contractor shall submit the following information to the Contracting Officer:

- a. Name, address, and citizenship of the proposed purchaser.
- b. Description, quantity, and location of the property.
- c. Final destination and end use of the property as asserted by the prospective purchaser.

The above requirements are in addition to all other restrictions and limitations, which are applicable with respect to such sales.

34. PERSONNEL

a. The Contractor shall use and employ nationals of the United States of America and/or Denmark in the performance of any of the work under this contract unless authorized in advance by the Contracting Officer in writing. The term "nationals of the United States of America," as used herein, shall mean all persons who have a permanent residence in the United States of America and all persons who are citizens (native-born or naturalized) of the United States of America. Term "Nationals of Denmark", as used herein, shall mean all persons who have a permanent residence in Denmark and all persons who are citizens (native-born or naturalized) of Denmark.

b. The Contractor shall make maximum use of Danish nationals (including Greenlanders) for the performance of the work under this contract, with due regard to Contractor cost, availability and technical qualifications, unless otherwise authorized in advance by the Contracting Officer.

c. Prior to local hire on part time basis of nationals of the United States of America, the Contractor will make every reasonable effort to use Danish labor. In any event, the Contractor shall obtain approval of the Contracting Officer for any local hire of nationals of the United States of America on part time basis.

d. For the purposes of this section, it shall be understood that people of Greenlandic origin shall be afforded the same recognition as provided for Danish persons.

35. DEPENDENTS AT THULE AIR BASE

Contractor personnel will be furnished housing only as specifically provided in this contract. No accommodations for dependents are available. No dependents of Contractor personnel will be permitted at

Thule Air Base.

36. RETURN OF CONTRACTOR PERSONNEL

The Contractor shall have the responsibility, at his expense, to effect return of his employees either to their respective countries of origin or to area of recruitment.

37. CONDUCT OF CONTRACTOR PERSONNEL

a. The location of the work in a foreign country Subject to Danish Law, places obligation on the Contracting Officer, the United States and local Danish law enforcing agencies with regard to the conduct of all United States citizens involved in the construction. Therefore, the Contractor shall promptly and accurately report to the Contracting Officer, immediately upon receipt and discovery, any and all information and date, whether or not verified, relating physical security incidents, misconduct, crimes, and misdemeanors, including but not limited to murder, arson, larceny of any weapon, ammunition, or explosives; larceny of other property; robbery, burglary; narcotics and dangerous drugs; destruction of Government property, fraud, malfeasance, and misfeasance; sabotage; subversion; disaffections; treasons; espionage. The Contractor shall recognize and comply with the rules and regulations promulgated by the foreign country where the work is to be performed to the extent required by pertinent international agreements but action in connections therewith shall at all times be subject to the prior approval of the Contracting Officer.

b. Each Contractor employee involved in the construction will be required to attend an orientation session, held by the provost Marshall, upon arrival at Thule. Danish laws relating to conduct of Contractor personnel while at Thule will be discussed.

c. The Base Commander may direct the Contractor in writing to remove any employee from the base when retention of such employee endangers life, property, or security or where such employee violates reasonable and necessary base regulations. When such a directive is received the Contractor shall promptly remove the employee from the base. The presence or use of intoxicating liquor (not including beer) other than for medicinal purposes as may be prescribed by a medical doctor, will be strictly controlled by the Contractor. The Contracting Officer may request, for sufficient reason removal of any Contractor Employee.

38. Not Used.

39. Not Used.

40. Not Used.

41. TRANSPORTATION AND PROCESSING OF PERSONNEL MATERIALS AND EQUIPMENT.

Wherever "Military Sea Transporting Service (MSTS)" appears, change it to "Military Sea Command, (MSC)". The Contractor shall be responsible for all necessary transportation of his personnel, materials, supplies and equipment, except that the Government will make available to the Contractor transportation services to the extent and under the terms and conditions as hereinafter provided as an optional method of transport. The Danish Government and CUAII, WASHINGTON, D.C must approve commercial aircraft flying to Thule. In addition to the instructions contained herein, the contractor shall follow the instructions provided in "Instructions 2004 Pacer Goose Resupply Shipping" (appended to this section). "Instructions 2004 Pacer Goose Resupply Shipping" shall govern in cases where it may conflict with the below.

a. Air Passenger: The U.S. Government will furnish air transportation of Contractor and Subcontractor personnel between the aerial ports of embarkation (BWIA) at Baltimore, MD. and/or such other aerial port of embarkation as may be designated by the Contracting Officer and Thule Air Base under following conditions:

(1) Number of air passengers will be subject to schedules of Military Mobility Command (MMC) aircraft and availability of space in each direction between the APOE McGuire AB, NJ, and Thule, AB, or its contracted air services for the duration of the contract. Specific allocations for each month will be based on Contractor's request to be submitted as required by subparagraph (2) below.

(2) Contractor shall submit to the Contracting officer in writing, an estimate of air passenger space required from APOE to Thule AB and return as provided under subparagraph (1), above for each of the first five calendar months of the contract, including the calendar month of award. Not later than one month after the month of award, the Contractor shall submit to the Contracting Officer an estimate of the required number of passenger spaces between APOE and Thule AB, and return for the fourth month after the month of such report, together with confirmation of changes in estimates previously submitted for the intervening month.

(3) The contractor shall be responsible for transportation of all Contractor and Subcontractor personnel involved, to the points of scheduled departure and all administrative and other related services. The Contractor at his own expense shall prepare all documentation of Contractor personnel. The Contractor shall furnish written notification to the Contracting Officer at Thule listing all such personnel arriving at the base, and indicating Theatre Clearance for each. Such written notification shall be forwarded to reach the Area Office not later than 48 hours prior to scheduled arrival. This also is required for Contractor personnel and crew arriving at the base by privately owned or commercial aircraft. This list shall include names,

social security/labor number numbers, and dates of travel.

(4) The Contractor shall pay to the Government in the manner hereinafter provided in subparagraph (2) above, for all air transportation furnished hereunder at the prevailing rates on date of transportation. An adjustment in contractor price will be made if the prevailing rates are other than the following:

One Way Passenger

<u>Between</u>	<u>Excess Baggage Charge per piece</u>	<u>(Including 70lbs. Personal baggage)</u>
McGuire AFB to Thule	\$70	\$608
Thule to McGuire AFB	\$70	\$608

(5) In the event that during any calendar month, the amount of passenger space as last confirmed or revised by the Contractor under subparagraph (2) is not utilized by the Contractor, the Contractor shall pay the government for such spaces not utilized at the applicable rates stated in subparagraph (4) above, except where such nonuse is caused by circumstances beyond the control of the Contractor. This subparagraph shall not apply to passenger space utilized during the first two calendar months of the contract.

(6) Should the Contractor require additional space over and above the maximum amount required to be furnished by the Government as provided in subparagraph (1) above, the Contractor shall be responsible for securing such additional space from commercial or other sources at his own expense. However, an effort will be made by the Contracting Officer to obtain additional space via MAC upon submission of a request at least 20 days prior to the actual month of use.

(7) The Contractor shall be responsible for arrangement for all clearances and other requirements to permit operation of commercial aircraft into and out of Thule, Greenland.

(8) The Contractor shall make payment for air transportation of personnel directly to MAC on periodic billings submitted by MAC to the Contractor. Copies of all billings shall be furnished to the Contracting Officer. The Contractor must establish an account with MAC prior to use.

(9) The U.S. Air Force, Military Air Command also charters SAS flights from Copenhagen, Denmark to Thule AB. There are also regular commercial flights (SAS) from Copenhagen to Sondrestrom, AB, Greenland. All flights are subject to change without notice.

b. Air Lift of Equipment:

(1) In view of the short construction season and the estimated date of arrival of the sealift at Thule on July 15, **limited air shipment is available, but at the contractor's expense. The approximate cost for**

airfreight from McGuire to Thule is provided in the below schedule:

Cargo Costs

0-439 LBS	is \$305.10 /LB
440-1099 LBS	is \$274.40 /LB
1100 - 2199 LBS	is \$244.40 /LB
2200 - 3599 LBS	is \$213.30 /LB
Above 3600 LBS	is \$187.80 /LB

TP4= Transportation Priority 4 (lowest priority) is \$2.87 per cubic foot

(2) The location of the area of departure of airlift is McGuire Air Force Base, Wrightstown, New Jersey.

(3) The Government will make available basis for transportation of Contractor's or subcontractor's cargo from APE to Thule Air Base. The Contractor shall exert every reasonable effort in planning his procurement and mobilization of supplies and equipment so that the amount of airlift required will be kept to a minimum consistent with the effective operation.

(4) The Contractor shall be responsible for transportation of all cargo involved to points of scheduled departure and all administrative and other related services. The Government will unload the cargo from the aircraft upon arrival at Thule Air Base at no charge to the Contractor. Cargo handled from the APOE terminal to the Contractor storage area shall be at the Contractor's expense. The Contractor shall be responsible for prompt movement of the cargo from the APOE terminal. All materials, supplies and equipment must be packed crated, and/or skidded in accordance with paragraph (5) hereof. The Contractor at his expense shall prepare all documentation of the cargo. It shall be the responsibility of the Contractor to deliver all his cargo to the freight terminal at McGuire AFB no later than 96 hours prior to the departure from McGuire AFB. The Contractor shall check the quantity and condition of the materials as they are deposited in the storage area at Thule Air Base, acknowledge receipt thereof in writing to the Contracting Officer, and in case of shortage of quantity or damage to said materials, he shall report such shortage and/or damage in writing within 24 hours to the Contracting Officer. Equipment and materials delivered to Thule Air Base in damaged condition will be reported by the Contractor to the Contracting Officer in writing within 24 hours.

(5) All materials, supplies and equipment to be transported under this section shall be properly packed and crated by the contractor in accordance with standard commercial practices. The Contractor shall contact the Transportation Specialist at the New York District for shipping instructions and transportation control number. Any repacking necessary because of inadequate original packing shall be at the Contractor's expense.

(6) Inside dimension of C-5, ~~C-17~~ and C-141 aircraft:

<u>Characteristic</u>	<u>Aircraft</u>		
	<u>C-141</u>	<u>C-17</u>	<u>C-5</u>
Length	93'- 4'		123'
Width	10'- 1"		19'- 0"
Height	8'- 0"		13'- 6"
Maximum Limit in lbs.	50,000		50,000

NOTE: Cargo space and weight limits will vary due to availability.

c. Surface Shipments:

(1) Shipments to Thule Air Base: The Government will furnish, to the Contractor, surface transportation to Thule Air Base of Contractor and subcontractor materials, supplies, and equipment, via Military Sea Command (MSC) from Military Ocean Terminal, Norfolk, Virginia or from such other east coast port of embarkation in the continental United States as may be designated by the Contracting Officer under the following conditions:

(a) Contractor shall submit NOT LATER THAN 15 MAY a priority listing of materials/equipment to include TCN numbers and descriptions required to be on the ship.

(b) The Contractor shall have a superintendent at Thule AB no later than 10 days prior to the first scheduled arrival of a surface shipment.

(c) The availability of surface transportation under the provisions of this paragraph (1) will be subject to vessel loading dates as scheduled by the Government and will not be determined by availability of the cargo. The annual Military Sea Transportation Service operation is limited to a 60-day period, normally the second week of July through the first week of September.

(d) The Contractor shall comply with all the requirements of subparagraph (3) below, before crating or delivery of any cargo to port of embarkation. In addition each package shall be marked as follows:

Ship To:	Marked for:
Fleet and industrial	Commander, 821 st Air Base Group
Greenland	Supply Center Thule Air Base,
Ocean Terminal Division	For: U.S. Army Corps of
Bldg. CEP-201	(Code 302) Engineers
Norfolk, VA 23511	Contractor:
	Contract No.:
	TCN:
	PCs: WT: CU:

(e) The Contractor shall deliver all cargo to the designated port of embarkation, at his own expense, as directed by the Contracting Officer, where the Government will receive and load same. Cargo must

be delivered to the port of embarkation a minimum of 14 working days prior to the berth date of the vessel as established by Military Sea Command. See Pacer Goose Attachment for further details.

(f) Upon arrival of the cargo at Thule AB, the Government will discharge the cargo from the vessels and transport same to the Contractor's main material yard or preliminary staging area, located in the port area of Thule AB, where the Contractor shall immediately unload same from the trucks with his offloading equipment. If the Contractor has no offloading equipment he may use Government offloading equipment on a reimbursable basis. Use of the equipment by the Contractor shall be on a non-interfering basis. During the port season the Government will be using crane equipment 12 hours per day, 7 days per week. When so requested by the Contracting Officer, the Contractor shall have a competent representative at the port of discharge for the purpose of rendering such technical advice on unloading and handling of the Contractor cargo as may be required. The Contractor shall follow the guidelines as outlined in current edition of Thule Air Base Summer Port Operation.

(g) Surface shipments may also be available from Denmark. Contact the following for details and arrangements:

Contract Administrator (Construction, A/E, Airlift & Sealift)
Detachment 1, 21 Contracting Sq. (DET 1)
c/o American Embassy
Dag Hammarskjölds Allé 24
DK-2100 Copenhagen Ø, Denmark
Attn: Renée Carelli

Renée C.: (45) 35 55 31 44 Ext. #468
DET 1: (45) 35 55 31 44 Ext. #456
Fax: (45) 35 26 51 08
E-Mail: renee.carelli@det1.dk

(h) Unusual Cargo: Advance coordination shall be made for unusual cargo. Large, bulky, or extra heavy cargo shall have delivery coordinated in order to facilitate any direct loading requirements of the carrier. Bulky is defined as exceeding 120 cu. ft. per ton, and extra-heavy as exceeding five (5) tons. The Government will not be responsible for damage of any cargo due to freezing. Cement shall be packed in accordance with USAF Water Port Logistics Office Instructions.

(2) Retrograde Shipments: The Government will furnish all required surface transportation from Thule Air Base of Contractor and Subcontractor materials, supplies, and equipment, based on availability of transport, by way of MSC, to east coast port of debarkation in the continental United States as may be designated by the Contracting Officer, under the following conditions:

(a) The Contractor shall, at the time the cargo is offered for shipment, furnish the Contracting Officer a list of all items to be retrograded to include weights and cube of each major item and the name and address of the final consignee.

(b) The Contractor shall expeditiously load Government trucks at Thule Air Base with cargo to be retrograded or shall make such cargo available at such place or places at the Base or port area and in such manner as may be directed by the Contracting Officer. The Contractor shall notify the Contracting Officer 14 days before the date he estimates his equipment will be ready for retrograde shipment. Retrograde of materials/equipment will be made in accordance with Thule Air Base Summer Port Operation manual, and shall be identified no later than 30 days prior to the scheduled departure of the vessel. However, all retrograde equipment and materials must be ready for shipment and received at dockside, ready for loading, no later than 15 August - any items received after the date will not be the basis for a claim if not retrograded.

(c) The United States Government will load and transport said cargo to the designated port of debarkation and unload same thereat.

(d) Upon notice to the Contractor of arrival of cargo at designated port of debarkation, the Contractor shall accomplish immediate removal thereof from said port of debarkation. Transportation of cargo from said port of debarkation and expense therefore shall be the responsibility of the Contractor.

(e) Contractor shall receive all materials within 14 calendar days of final offloading of each ship. The Contracting Officer shall be notified at that time of any materials not received and any material damages. Where damage has occurred, the Contractor should execute SF361 within 2 weeks of final offloading. Failure to follow these instructions will result in Government denial of any loss or damage claims.

(3) Packing:

(a) All materials, supplies and equipment to be transported under this paragraph 41, shall be properly packed and crated by the Contractor in accordance with standard commercial export practice. Any additional packing, binding or cooerage required by the Commanding Officer at the Port of Embarkation or at Thule Air Base shall be at the Contractor's expense.

(b) Metal pipe and conduit shall have ends capped or sealed with tape. Desiccants, if required to prevent corrosion, must be provided by the Contractor. Structural steel and rebar shall have extra heavily reinforced strapping to prevent separation during handling and shipping.

(4) Reports:

(a) Continental United States to Thule Air Base: The Contractor shall submit to the Contracting officer with his bid on the appropriate form the Contractor's estimate of cargo in measurement tons (40 cubic feet) to be transported by the Government under subparagraph b.(1) above, to Thule Air Base. The Contractor, upon request by the Contracting Officer, shall furnish a current status

report on all Contractor cargo ready for transportation, to or enroute to stateside port of embarkation which shall include shipping priorities, if requested.

(b) Thule Air Base to Continental United States: The Contractor shall submit to the Contracting Officer, ten days after award of contract, a written report, in a form acceptable to the Contracting Officer, stating in measurement tons the cargo to be transported by the Government under the subparagraph (2) above.

(c) The Contractor shall submit to the Contracting Officer reports of Contractor cargo received at or shipped from Thule Air Base at time of receipt of shipment both at Thule and at MOT, NORFOLK, VA.

(d) Markings: All cargo shipped by the Contractor shall be marked in accordance with, the provisions of MILSTAND 129-DOD 4500.32R, dated 1 January 1975 in addition, documentation for all cargo shipped by the Contractor shall indicate for each item:

(1) Name of commodity

(2) How item is packed (container, pallet, carton, drum, etc.)

(3) How many of each type package (1 of 3, 2 of 3, etc.)

(4) Gross weight of each.

(5) Dimensions (in inches) of each item in the following order; length, width, height.

(6) Before presentation of any items for shipment, the Contractor shall contact the Transportation Specialist at the New York District Office (212) 264-2461 with the above specified data (d(1) thru d(5)) for shipping instructions, military shipment labels DD Form 1387 or Tag 1387-1, and Material inspection and Receiving Report, DD Form 250 ALL OF WHICH WILL BE PREPARED BY THE CONTRACTOR. No shipments into ports will be effected without a Transportation Control Number (TCN), which will be supplied by the Transportation Specialist.

(7) Distribution of DD Form 250 and DD Form 1387 (2 copies): Insert in waterproof envelope. Securely attach to outside of package or package #1 if more than one package in shipment.

1 copy - Insert inside EACH package.

1 copy - Give to carrier upon pickup to present at air/water terminal port of export. (Dover AFB, DEL/NORFOLK NAS. VA/MOT, NORFOLK, VA). CARRIER MUST NOTE RELEASE NUMBER AFTER TON NUMBER FOR MOT, NORFOLK DELIVERY ONLY.

NOTE: FOR EACH PARTIAL SHIPMENT contact this office (212) 264-2461 for additional sets of DD Form 250 and DD Form 1387 - Military Shipping Label stating number and kind of pieces gross weight, and dimensions of each piece in length, width and height.

DD Form 1387- Cover completely with any clear waterproof material.

(e) Hazardous Materials: Shall be shipped in accordance with CFR Title 46, parts 146-149 and Title 49, parts 100-199 and Reg. AFM 71-4. In addition to the marking requirements listed above, hazardous materials shall be marked with destination, and flash point for flammable or combustible liquids in accordance with MILSTAND 129. Retrograde of all hazardous waste/materials is the responsibility of the Contractor. Hazardous Waste Identification Sheets must be certified, signed and funds must be made available by the Contractor for retrograde.

(f) Clearances: With respect to transportation services to be furnished by the Government under subparagraphs 41a, b, and c of this paragraph, the Contractor shall, at his own expense prepare and furnish the necessary documents and obtain clearances as may be required by applicable Government regulations covering delivery of cargo to the Government for overseas transportation.

Contractor arranged commercial ships are not preauthorized for loading at Military ports. Contractor is responsible for making all arrangements for loading and for obtaining clearances from appropriate officials from Denmark and Greenland. U.S. flagships should be used if available. If not, Danish flag ships should be used.

(g) Movement of Cargo via Contractor Chartered Commercial Vessels: With respect to Contractor cargo to be moved by the Contractor to Thule Air Base on a commercial vessel from any port, the Contractor shall submit in writing to the Contracting Officer at least 60 days prior to arrival of such cargo at Thule Air Base giving the type of cargo in long tons and measurement tons to be moved on each vessel, port of loading, port of discharge, expected date of departure of vessel and estimated time of arrival at destination. The Contractor shall notify the Contracting Officer, in writing, at time of actual departure of each vessel from the port of loading, giving date and time of departure from the port of loading, estimated time of arrival and cargo loaded in long and measurement tons. The Contractor shall arrange to have masters of vessels make periodic reports enroute informing the port of destination of any change of hour and date of arrival at Thule Air Base. The Contractor shall not arrange for any vessel to leave any port without prior approval of the Contracting officer.

(h) Loading and Unloading of Contractor's Commercial Vessels: The Government will load and/or unload cargo from the Contractor's commercial vessels at Thule Air Base and transport same to and from the Contractor's main material yard or primary staging area located in the project area of Thule Air Base, where the Contractor shall immediately load and/or unload same from the trucks when requested by the Contracting Officer or the Port Commander at Thule Air Base, the Contractor shall have a competent representative at the port of discharge for the purpose of rendering such technical advice on the loading and/or unloading and handling of Contractor cargo as may be

required. There shall be no charge to the Contractor for the services described in this paragraph.

(g) Insurance: The U.S. Government carrier carries minimum liability insurance, but does not carry all-risk marine insurance. The Contractor is responsible for his own marine insurance, and shall name the U.S. Government as co beneficiary.

42. MARKINGS ON GOVERNMENT AND CONTRACTOR EQUIPMENT AND PROPERTY

The Contractor shall comply with the following equipment marking requirements:

a. Government-Owned: All items of Government-furnished construction plant, including but not limited to mobile vehicles, tractors, cranes; secondary equipment such as trailers, trailer-mounted heavy stationary equipment, such as batch plants, crusher plants, etc., shall have the following marking conspicuously placed and maintained on both sides of each such vehicle or equipment:

GOVERNMENT OWNED (VEHICLE) (EQUIPMENT)

**OPERATED BY
(NAME OF CONTRACTOR)**

The marking shall be in legible and easily visible letters at least two inches high. The markings may be accomplished by stencils, using durable outdoor type paint or by firmly secured plaques or decals. Uniformity of markings is required.

b. Contractor-Owned: All Contractor-owned or Contractor-furnished construction plant including but not limited to the same categories of such items as listed in subparagraph (a) above, shall have the same marking as prescribed in subparagraph (a) above for Government-owned construction-plant except that the word "Contractor" shall be substituted in place of the word "Government" in said prescribed marking.

c. Prior to the return by the Contractor of Government-furnished construction plant equipment, the Contractor shall neatly remove the name of the Contractor.

43. GOVERNMENT FURNISHED SERVICES

The Government will make available to the Contractor for the duration of the contract the following services, free of charge, or at the rates noted below, subject to the regulations set forth by **the Thule Air Base Installation Commander**

- a. Not used.
- b. Billeting/Quarters

(1) Work Force. Contractor personnel will be billeted in available facilities, usually transient quarters furnished with beds, closets and lights, Individual maid service is not available. Once per week the Contractor shall arrange to bring soiled linen to the Linen Exchange and receive clean replacement linen. Contractor's own personnel shall clean assigned billets. Personnel paying short visits (14 days or less) will be billeted in transient quarters at prevailing rates.

(2) Contract Managerial Personnel, such as the Project Manager, who may be billeted in VOQ (Visiting Officers, Quarters), when available, will be charged \$28.50 per night inclusive of maid service and weekly linen exchange.

c. Messing Facilities and Food: Meals, at no cost to the Contractor, are scheduled at the Thule Mess Facility as follows:

Meal	Daily
Breakfast	0500-0800
Lunch	1100-1300
Dinner	1700-1900

Dining-facility hours are subject to change without notice. The Contractor shall coordinate his work shifts with the above schedule. Messing for transient personnel (14 days or less) will be on a cash basis at prevailing rates. Present rates are \$1.70 for breakfast and \$3.30 for lunch or dinner. The Contractor's personnel will **not** be issued **free** meal cards.

The Contractor is responsible for damage to messing facilities as caused by personnel tracking asphalt, tar, oil, grease, mud, etc., and will be charged any costs incurred for the repair or replacement of Government property.

d. Transportation: Contractor personnel may use the regularly scheduled Base bus system to go from one place to another on the Base.

e. Laundry and Dry Cleaning Services are available at prevailing rates, on a weekly basis. Rates and service times are posted in Building #97 (North Star Inn) and at the pick up point, Building #252.

f. Recreation Facilities including gymnasium, motion picture theater, access to the Top of the World Club, and Base Exchange are subject to the regulations as set forth by the Thule Air Base Installation Commander. Approval for establishing Contractor's Clubs and rules for their operations must be obtained from the Installation Commander. Individual users must pay the prevailing rates.

g. Vehicle and Equipment Maintenance: Maintenance and repair of Contractor-owned vehicles and equipment used in the performance of this contract will be the responsibility of the Contractor. Base maintenance shops may be made available to the Contractor for emergency repairs.

h. POL: Fuel products, oil and lubricants as required for Government -furnished equipment and Contractor-owned vehicles and equipment used in the performance of this Contractor will be sold by the U.S. Government at cost to the Contractor. Fuel products, oil and lubricants provided for Contractor-owned vehicles and equipment will be limited to such types as are readily available at the base and shall be purchased through base supply. Special products, not available at the base, shall be furnished by the Contractor at his own expense. The following POL products can be made available to the Contractor: DFA and Mogas. These will be issued to the Contractor using an approved Serv-O-Plate (AF Form 1252A) issued by Vehicle Maintenance. Information regarding this contract, including contract number, expiration date, as well as identification of vehicles and equipment must be provided to the Base O&M contractors.

i. Utilities: Water and electricity will be provided within allotted building workspaces from existing sources and outlets. No electrical power or outlets will be made available for work to be performed away from buildings. The Contractor shall furnish a generator, as necessary, to power any equipment or machines utilized to produce the aggregate stockpiles. The U.S. Government will not furnish electrical power for use in connection with production of aggregate. POL will be available on a cost reimbursable basis per subparagraph 43 h.

44. MEDICAL FACILITIES

The U.S. Government will make available to the Contractor's employees the use of the services and facilities of the Air Base Hospital at Thule.

a. Medical Care: Emergency medical care may be furnished to Contractor personnel at the base; consistent with necessity and available capability as determined by the Base Health Services Director at no cost to the contractor. Elective treatment will not be furnished. Patients whose disabilities will preclude their return to work, and those who require long-term continued treatment, will be reported to the Contractor for removal as soon as their condition allows.

b. Medical Escorts: Contractor employees evacuated to Denmark from Greenland due to accidents or critical illness may be accompanied by base medical personnel, if available. Determination as to the need for such escorts will be the sole responsibility of the Base Health Services Director. This medical escort will be on a reimbursable basis.

c. Transportation of unembalmed remains of deceased from Thule AB to appropriate aerial port of entry is on a reimbursable basis.

45. COMMUNICATION SERVICES

a. Intra Air Base Telephone Service: For the duration of the contract, Government owned telephone equipment presently in use at Thule Air Base will be made available to the Contractor in limited

quantities for his use in making calls between points on base. There will be no charge for this service or equipment.

b. Communication with State-side: Commercial service to Denmark is available through the Greenland Technical Organization communication system.

c. All of the above noted communication facilities will be provided on a when available basis. The Government assumes no responsibility for interruptions of service, regardless of cause.

46. ROADS AT THE AIR BASE

Roads on the base will be available to the Contractor, subject to the approval of the Contracting officer. However, heavy equipment and tracked vehicles will be prohibited from main base roads. The Contractor shall, however, comply with all base regulations. All drivers will be required to pass a driver's test acceptable to the Contracting Officer and hold Government approved license before operating on the base. All employees shall have an Arctic indoctrination briefing prior to the storm season, September 15 through May 15, as provided by the U.S. Government at no cost to the Contractor. Licenses are subject to revocation by the Government for traffic violation. It shall be the duty of the Contractor to so route his equipment as to meet existing overhead conditions. In no case shall the Contractor operate any construction equipment on any road or surface other than as shown on the Contract Drawings. In moving any cleated equipment or any other equipment which would damage surfaces, it shall be the duty of the Contractor to provide protection in the form of planking. The Contractor shall at his expense, repair all damage to roads caused by Contractor operated equipment.

47. MAINTENANCE OF UTILITIES

In the event of accidental disruption of an utility service caused by the Contractor's operation, the Contractor shall immediately notify the Contracting Officer's Representative and the Installation Commander and shall continue on a round-the-clock basis utilizing overtime labor on extra shifts as required until the service is restored. If restoration of service was effected by temporary or makeshift repairs, the necessary permanent repairs shall subsequently be made by the Contractor and shall be done at no cost to the Government.

48. ARCTIC PARKAS

The Government will furnish one parka per employee to the Contractor for his use during the length of the contract. At the completion of the work the contractor shall return all parkas issued, regardless of condition. Any missing parkas will be paid for by the Contractor at a rate of U.S. \$81.50 per parka. The U.S. Government will provide no other articles of arctic clothing.

49. SALVAGE AREA

Salvaged, non-hazardous materials or equipment shall be identified to the Contracting Officer and shall be returned to the Government as requested. All salvaged items must be properly documented and signed by the Contracting Officer in compliance with Base regulations. Returned materials shall be delivered to the landfill shown on the drawings or the DRMO yard at the Contractor's expense. No materials shall be placed within the landfills without prior approval.

50. ESTIMATED EQUIPMENT AND MANPOWER LIST

The Contractor shall prepare and submit to the Contracting Officer, no later than 10 days after award of contract, an estimated listing of equipment and manpower he expects to employ on the project site. In preparing the tabulation, the Contractor shall list all heavy equipment (trucks, lifts, loaders, etc.) which he intends to transport to Thule, using a separate line for each major item and as many pages as necessary. The last item listed shall be the estimated number of persons the Contractor expects to have in his employ at Thule AB.

ESTIMATED EQUIPMENT AND MANPOWER

Items and Quantity	Description: Item Mfr., Age, Condition, Capacity	Weight Long Tons (2240 lbs)	Measurement Tons (40 CU FT)	Air or Surface Shipment

51. PREFERENCE FOR U.S. FLAG AIR CARRIERS (APR 1984)

a. "International air transportation," as used in this clause, means transportation by air between a place in the United States and a place outside the United States or between two places both of which are outside the United States.

"United States," as used in this clause, means the 50 states, the District of Columbia, the Commonwealth of Puerto Rico, and possessions of the States.

"U.S.-flag air carriers," as used in this clause, means an air carrier holding a certificate under section 401 of the Federal Aviation Act of 1958 (49 U.S.C. 1371).

b. Section 5 of the International Air Transportation Fair Competitive Practices Act of 1974 (49 U.S.C. 1517) (Fly America Act) requires that all federal agencies and Government contractors and subcontractors use U.S. flag air carriers for U.S. Government-financed international air transportation of personnel (and their personal effects) or property, to the extent that service by those carriers is available. It requires the Comptroller General of the United States, in the absence of satisfactory proof of the necessity for foreign-flag air transportation, to disallow expenditures from funds, appropriated or otherwise established for the account of the United States, for international air transportation secured aboard a foreign-flag air

carrier if a U.S. flag air carrier is available to provide such services.

c. The Contractor agrees, in performing work under this contract, to use U.S. flag air carriers for international air transportation of personnel (and their personnel effects) or property to the extent that service by those carriers is available.

d. In the event that the Contractor selects a carrier other than a U.S. flag air carrier for international air transportation, the Contractor shall include a certification on vouchers involving such transportation essentially as follows:

CERTIFICATION OF UNAVAILABILITY OF U.S. FLAG AIR CARRIERS

I hereby certify that international air transportation of persons (and their personal effects) or property by U.S. flag air carrier was not available or it was necessary to use foreign-flag air carrier-service for the following reasons (state reasons):

e. The Contractor shall include the substance of this clause, including this paragraph (e), in each subcontract or purchase under this contract that may involve international air transportation. (FAR 52-247 -63)

52. VEHICLE FOR USE BY AREA ENGINEER

The Contractor shall supply a vehicle to the Area Engineer for his own use. This vehicle shall be a new four-door, six-passenger pick-up truck or SUV type vehicle, with 4-wheel drive and snow tires equipped for winter use and shall be equipped with an engine block heater. This vehicle shall have a radio capable of transmitting and receiving throughout the Thule Defense Area on two frequencies. Frequencies will be provided at the time of contract award. Maintenance of vehicle and radio shall be the responsibility of the Contractor. Radio equipped vehicle shall arrive with the Contractor's first sealift.

53. WORKER'S COMPENSATION INSURANCE (DEFENSE BASE ACT) (APR 1984)

The Contractor shall (a) provide, before commencing performance under this contract, such workers, compensation insurance or security as the Defense Base Act (42 U.S.C. 1651 at seq.) requires and (b) continue to maintain it until performance is completed. The Contractor shall insert, in all subcontracts under this contract to which the Defense Base Act applies, a clause similar to this clause (including this sentence) imposing upon those subcontractors this requirement to comply with the Defense Base Act. (FAR 52.228.3)

54. PROPERTY RECORDS

The Government shall maintain the Government's official property records in connection with Government property under this contract. The Government property clause is hereby modified by deleting the requirement for the Contractor to maintain such records (FAR 52.245-1).

55. **EXCHANGE RATE**

Any amounts given in this Section 00800 (Special Contract Requirements) that are denominated in dollars may be converted into Danish Kroners (DKR) by using the exchange rate of approximately 7 Danish Kroners equal to 1 U.S. dollar. For bid comparison purposes, the exchange rate on the day of the Bid Opening will be used. The contract award price will be based on the exchange rate of the contract award date.

56. **SPECIAL PROHIBITION ON EMPLOYMENT (APR 1987)**

(a) Definitions: "Arising out of a contract with the Department of Defense", as used in this clause, means any act in connection with (1) attempting to obtain, (2) obtaining, or (3) performing a contract or subcontract of any agency, department, or component of the Department of Defense.

"Conviction of fraud or any other felony," as used in this clause, means any conviction for fraud or a felony in violation of state or federal criminal statutes, whether entered on a verdict or plea, including a plea of nolo contendere, for which sentence has been imposed.

(b) Section 941, Title IX, Pub. L. 99-500 (10 U.S.C. 2408) prohibits a person who is convicted of fraud or any other felony arising out of a contract with the Department of Defense from working in a management or supervisory capacity on any defense contract, or serving on the board of directors of any defense contractor, for a period, as determined by the Secretary of Defense, of not less than one (1) year from the date of conviction. Defense contractors are subject to a criminal penalty of not more than \$500,000 if they are convicted of knowingly employing a person under a prohibition or allowing such person to serve on their board of directors.

(c) The Contractor agrees not to knowingly employ any person convicted of fraud or any other felony arising out of a contract with the Department of Defense, in a management or supervisory capacity on any Department of Defense contract or subcontract or allow such person to serve on its board of directors from the date the Contractor learns of the conviction until one (1) year has expired from the date of conviction. However, if the person has also been debarred pursuant to FAR Subpart 9.4, the above prohibition shall extend for the period of debarment, but in no event shall the prohibition be less than (1) year from the date of the conviction.

(d) If the knowingly employs a convicted person in a management or supervisory capacity on any defense contract or subcontract or knowingly allows such person to serve on its board of directors within the prohibited period, the Government may consider, in addition to the criminal penalties contained in Section 941 of Pub. L. 99-500, other available remedies, such as suspension or debarment, and may direct the cancellation of this contract at no cost to the Government, or terminate this contract for default.

(e) The Contractor agrees to include the substance of this clause, including this paragraph (e), appropriately modified to reflect the identity and relationship of the parties, in all subcontracts exceeding \$25,000.

57. HAZARDOUS MATERIAL IDENTIFICATION & MATERIAL SAFETY DATA
(AUG 1987)

(a) The Contractor agrees to submit a Material Safety Data Sheet (Department of Labor Form OSHA-20), as prescribed in Federal Standard No. 313B, for all hazardous material prior to loading materials on sea or air transportation, whether or not listed in Appendix A of the Standard. This obligation applies to all materials delivered under this contract, which will involve exposure to hazardous materials or items containing these materials.

(b) "Hazardous material," as used in this clause, is as defined in Federal Standard No. 313B, in effect on the date of this contract.

(c) Neither the requirements of this clause nor any act or failure to act by the Government shall relieve The Contractor of any responsibility or liability for the safety of Government, Contractor, or subcontractor personnel or property.

(d) The Contractor shall comply with applicable Federal, state, and local laws, codes, ordinances, and regulations (including the obtaining of licenses and permits) in connection with hazardous material.

(e) The Government's rights in data furnished under this contract with respect to hazardous material are as follows:

(1) To use, duplicate, and disclose any data to which this clause is applicable. The purposes of this right are to: (i) apprise personnel of the hazards to which they may be exposed in using, handling, packaging, transporting, or disposing of hazardous materials; (ii) obtain medical treatment for those affected by the material; and (iii) have others use, duplicate, and disclose the data for the Government for these purposes.

(2) To use, duplicate, and disclose data furnished under this clause, in accordance with subparagraph (e) W above, in precedence over any other clause of this contract providing for rights in data.

(3) That the Government is not precluded from using similar or identical data acquired from other sources.

(4) That the data shall not be duplicated, disclosed, or released outside the Government, in whole or in part for any acquisition or manufacturing purpose, if the following legend is marked on each piece of data to which this clause applies:

"This is furnished under United States Government Contract No. _____ and shall not be used, duplicated, or disclosed for

any acquisition or manufacturing purpose without the permission of _____. This legend shall be marked on any reproduction of this data."

(5) That the Contractor shall not place the legend or any other restrictive legend on any data which (i) the Contractor or any subcontractor previously delivered to the Government without limitations or (ii) should be delivered without under the conditions specified in the Federal Acquisition Regulation in the clause at 52.22714, Rights in Data.

(f) The Contractor shall insert this clause, including this paragraph (f), with appropriate changes in the designation of the parties, in subcontracts at any tier (including purchase designations or purchase orders) under this contract involving hazardous material. (FAR 52.223-3)

58. DISPLAY OF DOD HOTLINE POSTER (OCT 1987) (52.203-7003)

a. Except as provided in paragraph (c) below, the Contractor shall display prominently in common work areas within business segments performing work under DoD contracts, DoD Hotline Posters prepared by the Office of the Inspector General, DoD.

b. DoD Hotline Posters may be obtained from the DoD Inspector General, ATTN: Defense Hotline, 400 Army Navy Drive, Washington, DC 22202-2884.

c. (c) The Contractor need not comply with paragraph (a) above, if the Contractor has established a mechanism, such as a hotline by which employees may report suspected instances of improper conduct, and instructions that encourage employees to make such reports. (See DoD FAR Supplement 3.7000(c).)

59. SAFETY AND HEALTH REQUIREMENTS MANUAL

If this contract is for construction or dismantling, demolition, or removal of improvements with any Department of Army agency or component, the Contractor shall comply with all pertinent provisions of the latest version of U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, in effect on the date of the solicitation. The latest edition of the U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1 and its changes are available at <http://www.hq.usace.army.mil> (at the HQ homepage select Safety and Occupational Health). Contractor shall be responsible for complying with the current edition and all changes posted on the web as of effective date of this solicitation.

Before commencing the work, the Contractor shall: 1) Submit a written proposal for implementing the Accident Prevention Plan; and (2) Meet with representatives of the Contracting Officer to discuss and develop a mutual understanding relative to administration of the overall safety program.

60. CLEARANCE REQUESTS

The contractor shall have a properly executed AF Form 103, Base Civil Engineering Work Clearance Request (see Section 00904) coordinated thru the Contracting Officer and signed by the Base Civil Engineer before he starts actual site work for a project.

61. UTILITY OUTAGES

Utility outages must be coordinated with the Base Civil Engineer thru the Contracting officer at least 72 hours prior to the planned utility interruption. Power outage periods shall exclude Saturdays, Sundays and holidays.

62. WELDING PERMIT

An AF Form 592; USAF Welding, Cutting, and Brazing Permit, shall be obtained by the Contractor from the Base Fire Chief prior to any welding operations. Welding shall conform to AFOSH Standard 127-5 and such operations must be inspected and approved by Base Fire Department.

63. STANDARDIZATION

Where two or more items of the same type or class of equipment furnished in this project are required, the units shall be products of the same manufacturer and shall be interchangeable when of the same size; capacity, performance characteristics, and rating. The only exception to this requirement is where the items are interchangeable due to conformance with industry standards (valves, fittings, etc they need not be by the same manufacturer. This requirement applies to all manufactured items in the project, which normally require repair or replacement during the life of the equipment. This requirement becomes part of the provisions of Section 01330 SUBMITTAL PROCEDURES, and the Contracting officer reserves the right to reject items not meeting the above provisions.

64. AREA USAGE

The Contractor shall submit to the Contracting Officer for approval, within twenty (20) calendar days after receipt of Notice to Proceed, an Area Use Plan, designating intended use of all areas within the project site boundaries and other on Base areas proposed for use by Contractor. This plan shall include, but not be limited to the following: drawings showing temporary electrical installations; temporary water and sewage disposal installations; construction building installations; material storage areas; living facilities; and office or administration plant and temporary facilities.

65. REMOVAL OF CONTRACTOR EQUIPMENT, MATERIALS, TOOLS AND SUPPLIES

All construction equipment, materials, form system, tools and/or supplies belonging to the Contractor and required for the performance of this work but not incorporated into the work, will remain the property of the Contractor, and upon approval of the Contracting officer, the Contractor will be permitted to remove any of the same

from the work site.

1. The Contractor may use or re-sell same at his convenience and without additional cost to the Government so long as he complies with all USAF regulations at Thule AB, Greenland.

2. The Contractor shall also be permitted to export such equipment, materials, tools or supplies without payment of customs, duties, taxes, or other charges, except for services requested or ordered.

66. ENGLISH SPEAKING REPRESENTATIVE

At all times when any performance of the work at any site is being conducted by any employee of the Contractor or his subcontractors, the Contractor shall have a representative present at each site who has the capability of receiving verbal and written instructions in the English language, fluently speaking and writing the English language and explaining the work operations to persons performing the work in the language that those performing the work are capable of understanding. The Contracting Officer shall have the right to determine whether the proposed representative has sufficient technical and lingual capabilities, and the Contractor shall immediately replace any individual not acceptable to the Contracting Officer.

67. LANGUAGE

1. Translation: Drawings, specifications, instructions, or other documents furnished to the Contractor by the Government in connection with the performance of the work will be in the English language only. Such translations thereof as are necessary or proper for the performance of the work shall be provided by the Contractor. Errors or omissions in such translations from the Government furnished drawings, specifications, instructions or other documents shall be the responsibility of the Contractor. The English text shall govern in the event of disagreements occasioned by differences between the text and the Contractor's translation of drawings, specifications, instructions or other documents furnished by the Government pursuant to the provisions of the contract. All correspondence, drawings, and other documents submitted by the Contractor shall be entirely in English, except as otherwise provided in the contract. All translated certificates, licenses, test reports, and manufactures data are to be stamped by an authorized translator. All references in correspondence or other documents to monetary sums shall be furnished in United States dollars.

2. Discrepancy: In the event of a disagreement between the English text and any foreign language translation of this contract, the English will govern.

68. RESPONSIBILITY FOR PHYSICAL SECURITY

Prior to mobilization, the Contractor shall submit his proposed means of providing project security as defined below.

1. For the purpose of this clause, the term "physical security" is defined as that part of security concerned with the physical measures designed to safeguard personnel, to prevent unauthorized access to equipment, facilities, materials and documents, and to safeguard them against espionage, sabotage, damage, and theft.

2. Under the general supervision of the Contracting Officer, the Contractor shall be responsible for physical security of all materials, supplies, and equipment of every description, including property which may be Government-furnished or owned, and all work performed, and also of areas occupied jointly by the Contractor and the Government. The Contractor agrees to furnish to the Contracting Officer just prior to physical completion of all work under this contract, a consolidated inventory of all excess supplies, materials and equipment imported, duty free, for use under the terms of this contract.

3. The continued employment of any person in connection with this contract, or any subcontract there under whose conduct is determined to be prejudicial to the interests of the Government of Denmark, Ministry of Greenland or the Corps of Engineers shall be terminated and that person shall be immediately removed from the work upon request of the Contracting Officer at no cost to the Government. Compliance with the foregoing provisions of this paragraph by subcontractors shall be the responsibility of the Contractor.

4. The Contractor represents that the contract price herein include an amount sufficient to cover reasonable security measures based on local conditions. These measures shall be subject to approval by the Contracting Officer. There shall be no compensation for upgrading deficient security measures that are substandard due to an initial oversight in the security program.

5. The Contracting officer reserves the right at all times to issue instructions pertaining to the Contractor's jurisdiction and general conduct of guard forces including the extent if any, to which the Contracting Officer will desire the Contractor to initiate and maintain such liaison with other law enforcement agencies, and shall have the right to examine procedures, methods, records and facilities utilized by the Contractor in complying with the requirements of the Contracting Officer.

6. Examination of the Contractor's security methods, records, and facilities shall not be permitted by any person, agency or sources outside the Contractor's organization, other than the Government of Denmark, or the Contracting Officer, without the prior and express consent of the Contracting Officer.

69. SAFEGUARDING OF INFORMATION

The personnel employed on this contract may, in the performance of their assigned duties, have access to data and information pertaining to location of goods, supplies, parts, equipment, vehicles, and explosives. Knowledge of this nature is considered restricted security information. This information shall be protected and safeguarded against disclosure to any unauthorized person or party and shall be furnished or used on an official "need to know, basis only. Safeguarding of information is extended to dependents and guests of employees, who may in any manner, obtain knowledge of the Government of United States of America military capacity.

70. SECURITY CLEARANCES

All contractor employees will be subject to certain Security Clearance procedures by the Ministry of Greenland for Danish Nationals and United States Air-Force for American citizens. Employees will not be allowed to travel to or be admitted into the Thule Defense area prior to receipt of such a clearance. A minimum of seven (7) calendar days advance notice is required to obtain a travel clearance to the Thule Defense area.

71. GROUND FAULT CIRCUIT PROTECTION

All single phase wiring which is not part of the permanent wiring of a building or structure shall have Ground Fault Circuit Interrupters for personnel protection. This includes 120, 208, 220, 240 volt single-phase circuits. Some specialized equipment such as concrete vibrators may be sensitive to Ground Fault Circuit Interrupters. In cases where it is demonstrated that specialized equipment cannot be operated with Ground Fault Circuit Interrupters, other means of providing protection must be provided. Ground fault sensitivity shall be a maximum of five

(5) millamperes plus or minus one (1) milliampere for U.S. contractor employees and thirty (30) milliampere for European contractor employees.

72. NOT USED

73. IDENTIFICATION OF CONTRACTOR FACILITIES:

Contractor facilities will be arranged with the Base upon mobilization. Unheated space for equipment storage between construction seasons will be provided. No flammable materials or hot work (welding, etc.) will be allowed.

74. SPECIAL SCHEDULING REQUIREMENTS FOR MECHANICAL AND ELECTRICAL SYSTEMS

In reference to the contract clause entitled "PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS", see section entitled TESTING FOR MECHANICAL AND ELECTRICAL SYSTEMS for additional scheduling requirements for such systems.

75. SUBMISSION OF CLAIMS

The following shall be submitted to the Contracting at the following address: U.S. Army Corps of Engineers, New York District, 26 Federal Plaza, New York, New York 10278-0090:

a. Claims referencing or mentioning the Contracting Disputes Act of 1978.

b. Requests for a written decision by the Contracting Officer.

c. Claims certified in accordance with the Contract Disputes Act of 1978.

No other Government representative is authorized to accept such requests. A copy shall also be provided to the Authorized Representative of the Contracting Officer.

The Contractor shall also provide the Contracting Officer with a copy of any requests for additional time, money or interpretation of contract requirements which were provided to the Authorized Representative of the Contracting Officer and which have not been resolved after 90 days.

76. PRE-CONSTRUCTION CONFERENCE

a. A pre-construction conference will be arranged by the Contracting Officer, or his representative, after award of contract and before commencement of work. The Contracting Officer's representative will notify the Contractor of the time and date set for the meeting. At this conference, the Contractor shall be oriented with respect to Government procedures and line of authority,

contractual, administrative, and construction matters. Additionally, a schedule of required submittals will be discussed.

b. The Contractor shall bring to this conference the following items in either completed or draft form:

- The Contractor's order of work
- Accident Prevention Plan
- Quality Control Plan
- Letter appointing Superintendent
- List of subcontractors.

77. GOVERNMENT RESIDENT MANAGEMENT SYSTEM AND CONTRACTOR QUALITY CONTROL SYSTEM (QCS) MODULE

The Government will utilize an in-house Contract Administration program entitled "Resident Management System" (RMS). The Contractor shall utilize a Government furnished Quality Control System (QCS) Programming Module. See Section 01312A "Quality Control System (QCS)" for requirements.

78. CONSTRUCTION COLOR BOARD SUBMITTALS

The Contractor shall submit four sets of color boards depicting samples of all finish materials. The color board (finishes sample submittal package) shall include all visible exterior and interior materials and finishes that are a part of the building (and/or structure) or built-in items provided under this contract. The color boards shall be delivered to each of the addresses listed below in the section. The Contractor shall furnish his color board submitted to each of the addresses within 90 days after receipt of the notice to proceed, but more than 30 days prior to ordering finishing materials. The Contractor should obtain approvals of his entire color board submission before beginning any work involving final finishes. The Contractor shall use the following format when assembling the color boards:

a. Provide the samples on 8 ½ x11-inch board modules with a maximum spread of 25 ½ x33-inches for foldouts. Label the modules with the project titles and design them to fit in a standard loose-leaf, three-post binder. The modules should support and anchor all samples. Anchor large or heavy samples with mechanical fasteners.

b. Organize the submittals in a logical manner to allow a fast review. Write descriptions and explanations clearly. Drawings and photographs must be clear and concise.

c. Organize samples by scheme with a separate scheme for each room or for groups of rooms with the same scheme. Coordinate the schemes by room names and numbers shown on the architectural floor plans and room finish and color schedule. Include floor plans and schedules in modules.

d. Indicate true pattern color and texture for interior material and finish samples. Carpet samples should be large enough to

indicate a complete pattern or design, but not less than 3 by 5 inches.

e. Include color/finish pattern and texture for exterior materials and finishes

e. Provide at least a 6x6-inch square sample where either interior or exterior special finishes, such as architectural concrete or pre-finished textured metal panels, are required.

79. SPECIAL CONSIDERATIONS CONCERNING OFFEROR/AWARDEE

a. Award of any contract shall be in compliance with the 1962 Aide Memoire between the Governments of Denmark and the United States of America (US) in accordance with 10 U.S.C. 2304(c)(4), International Agreement. This agreement limits competition to only US or Danish firms.

b. Compliance with the requirements of Parts II and IV of Executive Order 11246, Equal Opportunity, shall not be mandatory, including any clauses/provisions in this contract which implement or supplement this Order, for work performed outside the US by employees who were not recruited within the US (per Federal Acquisition Regulation 22.807(b)(2)). However, such clauses/provisions have been retained in the solicitation and resulting contract and are applicable to any contractor/subcontractor who recruits employees from within the US for performance under this contract

80. SITE VISIT NOTICE

No formal site visit is scheduled. Bidder/Offerors wishing to visit the site prior to submitting their proposal are welcome to do so; however, any and all expenses associated shall be borne by the Bidder/Offeror. Requests for site visits shall be made in writing to the contracting officer in accordance with the clause at 52.236-27 in this section.

Bidder/Offerors are hereby put on notice that travel to/from Thule Air Base, Greenland is extremely limited and usually require a stay of at least a full week, if not more, based on scheduled flight availability. There are no commercially scheduled flights to Thule Air Base, only military or government charter flights, and daily or weekly flights are normally not available. Upon request, the contracting officer shall provide details concerning flight schedules, fares, lodging availability and associated costs, etc. Additionally, weather or other unforeseen conditions frequently cause extreme delays or cancellations of the scheduled flight resulting in extended stays of days to weeks in duration. Delays are common and the government shall not be held responsible for any additional costs incurred resulting from such delays.

Any question(s) fielded at a site visit shall be made available with the government's response to all Bidder/Offerors by amendment to the solicitation [unless such question(s) can be answered by directly referencing existing information in the solicitation, including specifications and drawings, without further interpretation].

81. QUESTIONS CONCERNING CLARIFICATION OF THE SOLICITATION

Any and all questions concerning this solicitation shall be submitted to the contracting officer in writing as soon as possible. Any questions not answerable by directly referencing existing information in the solicitation shall be made available to all Bidders/Offerors with the government's response by means of an amendment to the solicitation. Bidders/Offerors should submit questions concerning this solicitation within the first two weeks of the date of issue. Questions submitted within 10 days of the date for receipt of bids/offers may go unaddressed to preclude unnecessary delays in award.

82. NOTICE REGARDING CENTRAL CONTRACTOR REGISTRATION

Evidence suggests that Bidders/Offerors to which this solicitation is reserved (U.S. and Danish firms, including provinces and territories thereof) can comply with the requirements of clause 52.204-7, Central Contractor Registration. Therefore the requirements of this clause shall be upheld unless proof to the contrary is offered.

83. OTHER APPLICABLE THULE REGULATIONS TO FOLLOW:

Hazardous Waste Management Plan – CDRL 0526 dated July 2003

Spill Prevention & Response Plan - CDRL 0527 & 0528 dated March 2000

Solid Waste Management Plan – CDRL 0529 dated July 2003

Executive Summary of the Final Governing Standards for United States Forces in Greenland (FGS-GL) - dated 24 July 2003

Final Governing Standards for Environmental Protection by United States Forces in Greenland (FGS-GL) - dated 24 July 2003

INSTRUCTIONS 2004 PACER GOOSE RESUPPLY SHIPPING

1. GENERAL SHIPPING INSTRUCTIONS

a. POINT OF CONTACT

- (1) Movement of all PACER GOOSE sealift cargo into the Military Ocean Terminal, Norfolk, VA will be coordinated by the Military Ocean Terminal PACER GOOSE Coordinator in Norfolk VA

Point of Contact:
MS. LIBBY BISHOP
PACER GOOSE COORDINATOR
Commercial Phone: 757-444-3032/444-4714 to leave a msg
DSN: 564- FAX 757-444-8953 DSN 564-
E-mail (Libby.Bishop@navy.mil)

- (1) Refer all transportation problems relating to PACER GOOSE to the above numbers or mail to:

Mailing Address:
Fleet and Industrial Supply Center
Attn: Code 302 (Ms. Libby Bishop)
9248 Virginia Ave Bldg CEP-201

Norfolk VA 23511

2. TRANSPORTATION/DODAACS

All cargo destined for consignees cited below will be delivered to the following address:

Fleet and Industrial Supply Center
Military Ocean Terminal (N45631)
Bldg Cep-201 9248 Virginia Ave
Norfolk VA 23511

NOTE: RPS and UPS deliveries are accepted at the Military Ocean Terminal. However, in the case of small packages, check for mail/parcel post eligibility before sending them to the Military Ocean Terminal.

The following information must be supplied to the appointment desk:

- 1. Transportation Control Number (TCN)**
- 2. Port of Discharge (POD) (AQ1 For Greenland)**
- 3. Advance paperwork, i.e.,GBL,CBL,TCMD, FAX to 757-444-7149 DSN 564**
- 4. Consignee (Example: FB2507) Pcs, Wt, CU**
- 5. TAC (Transportation Account Code)**
- 6. Carriers call for appointment at least 24 HRS in advance to Coml 757-444-1125, EXT 109 oml**
- 7. or 564-1125 EXT 109 DSN—Hrs of operation are 0800-1500 M-F excluding Holidays**

The following DODAACs or Consignee Codes are in effect:

<u>CONSIGNEE CODE</u>	<u>LOCATION</u>	<u>WATER PORT</u>	<u>APO ADDRESS</u>
FB2507	12 SWS/LGS Thule AB,GR *(Also FE/FF/FJ/FL/FP/FS2507	(AQ1 for all)	(most used consignee) APO AE 09704-2501
FU2514 (computer) APO AE 09704-8250			12 SWS/SCX Small computer serv ctr Thule AB, GR
FY7556	12 SWS/MAO Thule, AB GR		APO AE 09704-0000
FY8306	USAF HOSP Thule Thule AB , GR		(medical) APO AE 09704-5000
HQCZZZ	Troop Issue Facility OL B1 FCS Thule AB		(subsistence) APO AE 09704-5000
HFXTSK	AAFES Europe Region Bldg 251 Thule AB, GR		(exchange) APO AE 09704-0000
EY1169	GR contractors		APO AE 09704-2501

*Transportation Control Numbers (TCNs) with the prefix of “FE” are for equipment items and/or vehicles. The TCN prefix “FF” is for Non Appropriated Funds (NAF) items.

3. REFERENCES/DIRECTIVES

These instructions are directive in nature to all supplying and shipping activities in accordance with:

- AFMAN 23-110
- AFI 24-201, Cargo Movement
- AFI 24-202, Packing Procedures
- DOD 4500.9-R DEFENSE TRANSPORTATION REGULATION, PART II (DTR), Cargo Movement
- REF: AFMC web site for TAC Information

4. TRANSPORTATION

- It is imperative that shippers comply with the established deadline delivery date of 1 JUN 2004. Shipments that cannot meet this requirement should call 757-444-4714 and talk to Steve Fisher or Libby Bishop for special arrangements.
- The Norfolk Military Ocean Terminal (BLDG CEP-201) is located on the Norfolk Naval Base in Norfolk Va. All trucks must enter truck control for inspection prior to entering Gate 5/directions are available at the Truck Control Center

5. VENDOR/CONTRACTOR OWNED CONTAINERS must comply with the following:

- Convention for Safe Containers (CSC) approved plate, which certifies the container meets all safety standards, an International Institute of Containers Lessors (IICL) label or an Approved Continuous Examination Program (ACEP) label.

- Net cargo weight loaded in 20 foot container cannot exceed 35,000 pounds.
- Containers marked with six inch lettering on all four sides, with name or initials of company/contractor and container number. Waterproof labels or paint may be used.
- If hazardous cargo is loaded in the containers, proper hazardous placards must be affixed to the outside of container and commodity codes/documentation must reflect hazardous shipments.
- Containers will not be booked to or through a commercial steamship line
- RAIL: No Rail service
- General cargo under 70 pounds can be mailed directly to the below address

12 SWS (FB2507)
THULE BASE SUPPLY ACCT
APO AE 09704-5000

- Cargo transported by air with a Project Code of 145 (PACER NORTH)
Must comply with the following instruction:

Move all freight with Project Code 145 to the following address:

TMO
BLDG 2251 Grissom RD
McQuire AFB NJ 08641

DEL 0730-1630 M-F call 609-754-3434 or 4904

Semi-perishable subsistence for the Artic must not be shipped into the Military Ocean Terminal (MOT) prior to 1 MAY 2004 or after 15 JUN 2004. Subsistence must have a shelf life of at least nine months and should be packed (newest date) and waterproofed (plastic wrapping) to meet the most hazardous weather conditions.

Vessels loading at the MOT for the Artic are self-sustaining break-bulk vessels. All cargo must be export packed to meet the most hazardous weather conditions.

6. DOCUMENTATION

- An information copy of all initiated contracts, purchase orders, GBLs, CBLs and DD Form 1384 (TCMD) will be furnished to the PACER GOOSE Coordinator (see Page 1)
- Prepared commercial bills of lading will be used. Cargo will not be forwarded on collect commercial bills of lading.
- Shippers required to use MIL-STD-129N will ensure that a copy of the DD Form 1348-1A identifies the type of containers shipped in "Shippers Use Section, Box 18 Type of Containers". DD Form 1348-1A should be applied and positioned on the containers as specified in MIL-STD-129N.
- Vendors forwarding shipments on PACER GOOSE purchase orders will ensure the following:

Packing list attached to the outside of the number one container of each shipment
Packing list must contain:

- List of Material
- Shipper
- Consignee
- TCN (Transportation Control Number)
- Requisition Number
- Item Number

- Quantity

HAZARDOUS CARGO WILL BE PACKAGED, LABELED, AND SHIPPED In Accordance with International Maritime Dangerous Good Code (IMDG) and Code of Federal Regulations (CFR 49)

Description of cargo, proper shipping name (PSN), IMCO Number, UN Number, Page Number and Flashpoint (for flammable liquid) must appear on all documentation. Each shipment will have its' applicable Material Safety Data Sheet (MSDS) attached to the freight and accompanying documentation.

Hazardous cargo must not be mailed to CONUS POEs. Cargo should be delivered by common carrier to water ports. HAZ cargo for airlift contact McQuire AFB NJ for requirements.

MARKING

All cargo will be marked in accordance with MIL-STD-129N. Containers are to be marked with paint or waterproof ink in characters from one to three inches high depending upon the size of the container. Each package must be numbered in series (1 of 4, 2 of 4, etc.). Each unit with a TCN should be identified and packaged separately. Do not use consolidated TCNs. Unidentified internal content TCNs will result in no proof of delivery at the port, no in transit visibility (ITV), and non-receipt of those items by the consignee (GREENLAND). All TCNs should be identified for trucking appointments at the port. This will ensure that the delivery paperwork and TCNs cross-reference.

- Packages under ten cubic feet will be marked on one side only
- Packages over ten cubic feet will be marked on two sides.
- Containers will be marked with the following:

Gross wt of container and contents

Cubic feet of container

Complete "Ship to" address as indicated on purchase order or requisition including destination station.

Shippers name and address

TCN (Transportation Control Number)

The Project Code number and title must be shown on the cargo. Where no Project Code appears, use Y31 PACER GOOSE

Consignee

Port of Discharge (POD) (AQ1-PACER GOOSE/Greenland cargo)

*****NOTE TO ALL CONTRACTORS/SUB-CONTRACTORS/VENDORS*****

ANY CARGO THAT COMES INTO THE OCEAN TERMINAL THAT IS NOT PROPERLY MARKED, AND IDENTIFIED, I.E., FROM/TO/POE/POD/MARK FOR/CONSIGNEE/TRANSPORTATION CONTROL NUMBER (TCN), WILL CREATE A DELAY IN DELIVERY AND ANY COSTS INCURRED WILL BE BORNE BY THE CONSIGNOR.

- Packages containing fragile items will be marked: "FRAGILE" with red paint or waterproof ink or by affixing an appropriate label to the containers.
- All bundles of metal beams, pipe, etc., will be marked by securely affixing two waterproof shipping tags or labels to each bundle. However, due to the paper tag or label frequently lost or destroyed, it is recommended that metal (aluminum or equal) tags marked with applicable shipping information be secured to two different surfaces of each bundle. If individual pieces are large enough, each bundle may be appropriately addressed by stenciling with a contrasting color of paint.

7. PACKAGING

- Maximum packaging protection to meet the most hazardous weather conditions, including weatherproofing (plastic wrapped) is required in support of the Annual Resupply of Greenland. This level of protection is necessary for the loading on deck, transfer at sea, helicopter delivery and offshore or over-the-beach discharge consistent with PACER GOOSE Operations.
- Suppliers will consolidate items by organization at Thule AB to the maximum extent possible. Fragility and compatibility of the items packed must be considered. Items in glass containers and hazardous cargo (ex: battery acid) will be packed in wooden boxes only.
- All palletized cargo must not exceed forty eight (48) inches in height; 3000 pounds in weight and cargo on top of the pallet must be flat. When configuration of palletized cargo is in doubt, please call PACER GOOSE coordinator.
- Case for canned goods including paint will be packed on two-way entry, 40”X48” pallets. Pallets must have a four-inch minimal clearance for material handling equipment (forklift) entry. Palletized loads will be provided with a wood or fiberboard cap, and loads will be banded four ways with ¾” steel banding. (See para. C.for palletized cargo).
- Bagged goods must be packed with poly-wrap, covered with fiberboard, palletized, shrink-wrapped and secured with plastic banding. (See para.c. for palletized cargo).
- Metal products such as pipe, angle, sheet, channel, tubing, etc. (which are susceptible to breakage of retaining bands during shipment) will be packaged in bundles squared to the maximum extent and should not (normally) exceed 1,000 pounds gross weight. Bundles will be strapped to four-inch high cross cleats using 1 ¼” steel strap girth bands applied not more than 24 inches apart.
- Reinforcement bars (rebars) must be crated or securely bundled. If bundled, 9/64” tie wires must be used for strapping bundles in four different places. Waterproof marking labels should be affixed to bundle in four places. Bundles must be strapped securely to prevent rebars from separating while being lifted by forklift.
- Shipments of compressed gas cylinders will be packed and shipped in accordance with CFR 49, Part 177.840(a)(1)”To prevent their overturning, cylinders containing Class 2 (gases) materials must be securely lashed in an upright position; loaded into racks securely attached to the motor vehicle; packed in boxes or crates of such dimensions as to prevent their overturning; or loaded in a horizontal position. Specification DOT-4L cylinders must be loaded in an upright position and securely braced.
 - a. A wooden collar constructed high enough to protect caps/valves will be placed on top of each palletized load encircling all caps.
 - b. Materials measuring 2”X8” will be used in the construction of the pallet base and collars with 3”X4” material used for stringers. Four-way 1 ¼ banding will be applied to attach collar and cylinders to the pallet.
- 55 gallon drums must be palletized, 3 drums on a 40”X48” pallet with four way steel strapping. 3 drums on a pallet is preferable so that maximum utilization of the container can be achieved. On large orders, please call the PACER GOOSE coordinator.
- Paper products and plywood should be palletized and covered with plastic. Plywood should be delivered on open flatbed trucks.

- Drywall (sheet rock) and gypsum wallboard must be crated or palletized and four-way banded. Material must be covered with plastic to prevent damage from the weather, however, four-way entry on pallet must be clear of plastic. This cargo should be delivered on open flatbed trucks.
- Lifting eye/plates must be properly installed by the manufacturer on heavy lift and oversize cargo.
- Carpet/rugs. These must be in rug tubes wrapped in waterproof plastic to meet hazardous weather conditions.

ALL CARGO MUST BE EXPORT PACKED TO MEET THE MOST HAZARDOUS WEATHER CONDITIONS. THERE ARE NO PACKING AND CRATING FACILITIES AT THE MILITARY OCEAN TERMINAL TO CORRECT PACKING DISCREPANCIES.

8. VEHICLES

- Outside dimensions of vehicles should be reduced to the maximum extent prior to shipment. If vehicles exceed eleven feet in height, notify the PACER GOOSE coordinator prior to shipment.
- Size permitting, vehicles should be shipped in closed containers over-the-road to prevent pilferage and damage.
- Vehicle's technical maintenance and parts manuals/literature must be sealed in a plastic bag and placed in glove compartment, or secure place, of each new vehicle. If not packed in vehicles, manuals will be mailed directly from vendor's plant post paid to the Transportation Officer/Superintendent at the overseas activity (consignee) for which vehicles are consigned.
- Corrosion treatment of PACER GOOSE vehicles will conform to vendor's standard commercial practice. Special processing such as Type "A" winterization must be accomplished prior to shipment of vehicles to the port.
- Placard or shipping label must be affixed to the front inside windshield showing the following information:
 - a. Transportation Control Number (TCN)
 - b. Port of Discharge (POD) (AQ! For Greenland)
 - c. Consignee (Ex: FE2507)
 - d. Purchase order/Contract Number
- For identification purposes each vehicle must be assigned a separate Transportation Control Number (TCN) regardless of how many vehicles are shipped/delivered together. If only one TCN is cited on a contract, change suffix on TCN for each vehicle before the vehicle is shipped by vendor to CONUS WPOE. Example: Contract reads FE25076295X001XXX for four vehicles. Use TCNs FE25076295X001XAX, XBX, XCX, and finally XZX. The "Z" designates the last of the four. If vehicles are accompanied by parts, i.e., shovel/blades, please annotate a separate suffix.
- On heavy lift vehicles, lifting eyes/plates must be properly installed on vehicles at vendor's plant.
- Markings and data plates IAW MIL-STD-129N with the following exception:

"U.S. Air Force, Vehicle Reg Number and For Official Use Only" are not required on the sides or rear of the vehicle. However, the vehicle reg number and contract number are still required on the vehicle data plate IAW MIL-STD-129N. (Also, vehicle reg number and contract number must be shown on DD Form 250)

First aid kits, small axes, fire extinguishers, etc., must be placed in a wooden box and secured to vehicle.

NOTE REGARDING DISTRIBUTION

Instruction may be reproduced as required. Contact will be made by e-mail whenever possible. Please disseminate to personnel at the lowest supply and shipping echelons to include all contractors, sub-contractors, and vendors involved in the program.

PROJECT IDENTIFICATION SIGN MILITARY PROJECT

The graphic format for this 4' x 6' sign panel follows the legend guidelines and layout as specified below. The large 4' x 4' section of the panel in the right is to be white with black legend. The 2' x 4' section of the sign on the left with the full corps Signature (reverse version) is to be screen printed Communications Red on the white background. The castle insignia will be furnished by the Government in pressure sensitive vinyl for affixing by the Contractor. See attached sheet for fabrication and mounting guidelines.

SAMPLE:

Legend Group 1: One- to two-line description of Corps relationship to project
Color: White
Typeface: 1.25" Helvetica Regular
Maximum line length: 19"

Legend Group 2: Division or District Name (optional). Place below 10.5" Reverse Signature (6" Castle)
Color: White
Typeface: 1.25" Helvetica Regular

Legend Group 3: One- to three-line project title legend describes the work being done under this contract.
Color: Black
Typeface: 3" Helvetica Bold
Maximum line length: 42"

Legend Group 4: One- to two-line identification of project or facility (civil works) or name of sponsoring department (military).
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

Legend Group 5a-b: One-to-five line identification of prime contractors including: type (architect, general contractor, etc.), corporate or firm name, city, state. Use of Legend Group 5 is optional.
Color: Black
Typeface: 1.25" Helvetica Regular
Maximum line length: 21"

All typography is flush left and rag right upper and lower case with initial capitals only as shown.
Letter and word spacing to follow Corps standards as specified in * Appendix D

Sign Type	Legend	Panel Size	Post Size	Specification Code	Mounting Height	Color Bkg/Lgd
CID-01	various	4' x 6'	4' x 4'	HDO-3	48"	WH-RD/BK

(Dimensions are in inches)

* Refers to the U.S. Army Corps of Engineers, "Sign Standards Manual", EPS-310-1-6.

SAFETY PERFORMANCE SIGN

The graphic format, color, size and type-faces used on the sign are to be reproduced exactly as specified below. The title with First Aid logo in the top section of the sign, and the performance record captions are standard for all signs of this type. Legend Group 2 and 3 below identify the project and the contractor and are to be placed on the sign as shown. Safety record numbers are mounted on individual metal plates and are screw-mounted to the background to allow for daily revisions to posted safety performance record.

Legend Group 1: Standard two-line title "safety is a Job Requirement", with (8" od.) Safety Green First Aid logo. Color: To match PMS 347
Typeface: 3" Helvetica Bold
Color: Black

Legend Group 2: One- to two-line project title legend describes the work being done under this contract and name of host project.
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

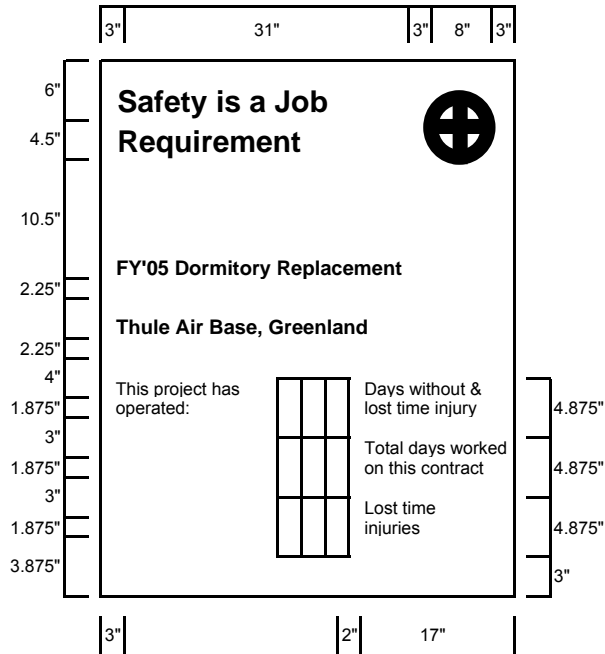
Legend Group 3: One - to two-line identification: name of prime contractor and city, state address.
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

Legend Group 4: Standard safety record captions as shown.
Color: Black

Typeface: 1.25" Helvetica Regular

Replaceable numbers are to be mounted on white .060: aluminum plates and screw-mounted to background.
Color: Black
Typeface: 3" Helvetica Regular
Plate size: 2.5"x.5"

All typography is flush left and rag right, upper and lower case with initial capitals only as shown. Letter- and word-spacing to follow Corps standards as specified in Appendix D. *

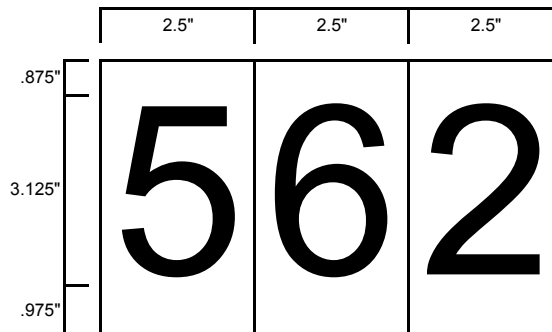


Dimensions inches.

See attached sheet for fabrication and mounting guidelines.

* Refer to the U.S. Army Corps of Engineers, "Sign Standards Manual", EPS-310-1-6.

Sign Type	Legend Size	Panel Size	Post Size	Specifications Code	Mounting Height	Color Bkg/Lgd
CID-02	various	4"x4"	4"x4"	HDO-3	48"	WH/BK-GR



Fabrication and Mounting Guidelines

As Construction Project Identification signs and Safety Performance signs are to be fabricated and installed as described below. The signs are to be erected at a location designated by the contracting officer and shall conform to the size, format, and typographic standards shown on the attached sheets.

The sign panels are to be fabricated from .75" High Density Overlay Plywood. Panel preparation to follow HDD specifications provided in Appendix B. **

Sign graphics to be prepared on a white non-reflective vinyl film with positionable adhesive backing.

All graphics except for the Communications Red background with Corps signature on the project sign are to be die-cut or computer-cut non-reflective vinyl, pre-spaced legends prepared in the sizes and typefaces specified and applied to the background panel following the graphic formats shown on the attached sheets.

The 2'x4' Communications Red panel (to match PMS-032) with full Corps signature (reverse version) is to be screen printed on the white background. Identification of the District or Division may be applied under the signature with white cut vinyl letters prepared to Corps standards. Large scale reproduction artwork for the signature is provided on page 4.8 (photographically enlarge from 6.875" to 10.5"). **

Drill and Insert six (6) .375" T-nuts from the front face of the HDD sign panel. Position holes as shown. Flange of T-nut to be flush with sign face.

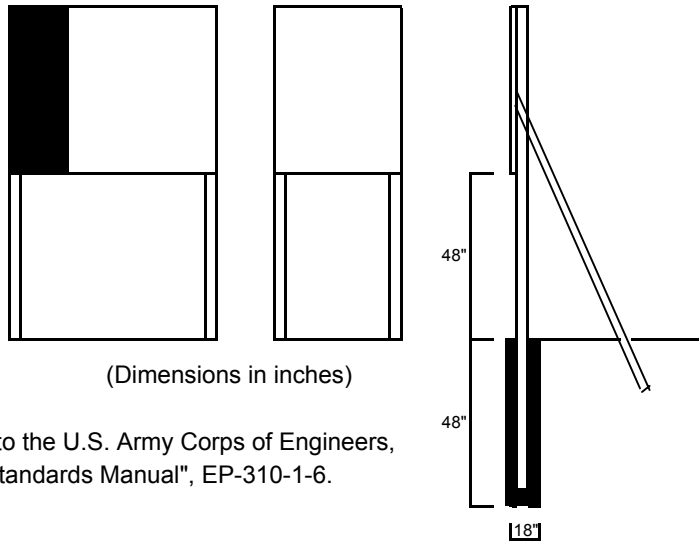
Apply graphic panel to prepared HDD plywood panel following manufacturers' instructions.

Sign uprights to be structural grade 4"x4" treated Douglas Fir or Southern Yellow Pine. No.1 or better. Post to be 12" long. Drill six (6) .375" mounting holes in uprights to align with T-nuts in sign panel. Countersink (.5") back of hole to accept socket head cap screw (4"x.375").

Assemble sign panel and uprights. Imbed assembled sign panel and uprights in 4" hole. Local soil conditions and/or wind loading may require bolting additional 2"x4' struts on inside face of uprights to reinforce installation as shown

Detailed specifications for HDD plywood panel preparation are provided in Appendix B. **

Shown below the mounting diagram is a panel layout grid with spaces provided for project information. Photocopy this page and use as a worksheet when preparing sign legend orders.



** Refers to the U.S. Army Corps of Engineers, "Sign Standards Manual", EP-310-1-6.

Construction Project Sign Legend Group 1: Corps Relationship

1. _____
2. _____

Legend Group 2: Division/District Name

1. _____
2. _____

Legend Group 3: Project Title

1. _____
2. _____
3. _____

Legend Group 4: Facility Name

1. _____
2. _____

Legend Group 5a: Contractor/A&E

1. _____
2. _____
3. _____
4. _____
5. _____

Legend Group 5b: Contractor /A&E

1. _____
2. _____
3. _____
4. _____
5. _____

Safety Performance Sign Legend Group 1: Project Title

1. _____
2. _____

Legend Group 2: Contractor/A&E

1. _____
2. _____

SECTION 00901

SUMMER PORT OPERATIONS

03/02

PART 1 GENERAL

1.1 GENERAL

This regulation outlines the responsibilities of the 1012th Air Base Group activities, including support organizations and contractors, for implementing the annual supply and transportation actions applicable to Thule Air Base. It applies to all activities that requisition supplies on an annual basis.

Supplies are transported aboard Military Sealift Command (MSC) and KALAALLIT NIUERFIAT (KNI) surface vessels, and are offloaded using local stevedoring capability.

General: Project Pacer Goose identifies the annual summer resupply of Thule Air Base, Greenland. Pacer Goose utilizes sealift transportation to the maximum extent during the summer port operating months. Period of operation will normally be 60 days between 1 July and 15 September.

1.1.1 Responsibilities

- a. The 1012 ABG Director of Logistics (1012 ABG/LG) is responsible for formulating and reviewing the Pacer Goose policy.
- b. The 1012 ABG/LGT is the Military Water Port Liaison Officer and Port Operations/Resupply Monitor and will:
 - (1) Monitor the stevedoring contract and overall port operation.
 - (2) Advise the 1012 ABG Commander and 1012 ABG/LG of:
 - (a) Ship arrivals and departures.
 - (b) Progress of loading and offloading of ships.
 - (c) Accidents or incidents occurring during port operations.
 - (d) Problem causing, or which could cause, a delay in ship loading or offloading.
 - (3) Upon arrival of Danish sea vessels, advise Danish Liaison Officer, Danish Police Inspector, and MSC representative.
 - (4) Coordinate port activities with the MSC Representative.
 - (5) Inspect ship's holds, with Port Operations Superintendent and

ship's representative, prior to offloading for evidence of pilferage.

(6) Notify Security Police of all ship arrivals.

(7) Provide information to ship's masters concerning use of on-base facilities and driving regulations.

c. Greenland Contractors Transportation (GC/LGT) will perform those functions specified in the current Statement of Work (SOW) specifically to include:

(1) Port Superintendent.

(a) Submit a semi-monthly summary of operations to the 1012 AGB/LG. These summaries will commence with the opening of the port and will conclude at the closing of the port. They must reach the LG no more than four working days after the closeout of the report.

(b) Coordinate port activities with the Port Operations Monitor and the MSC Representative.

(c) Immediately advise the Port Operations Monitor and MSG Representative of problems encountered, or potential problems, and damage to equipment, or incidents, that could delay the loading or offloading of ships.

(d) Immediately advise Port Operations Monitor and MSG Representative of accidents involving injury to personnel.

(e) Advise Port Operations Monitor and consignee of pilferage and/or damages which were not noted or could not be evident on initial batch inspection by the Port Operations Monitor.

(f) Contact Chief of Security Police to request security police guards for offloading ammunition and explosives.

(g) Coordinate with Base Photo Lab to take pictures of damaged cargo and items for after action report.

(h) Monitor and record the number of hours expended in support of KALAALLIT NIUERFIAT (KNI) when offloading non-Air Force sponsored cargo.

(2) Vehicle Operations:

(a) Furnish material handling equipment and vehicles to Port Clearance and Stevedoring Section, when necessary through withdrawal from other base units.

(b) Provide bus service as required during periods when ships are in port.

(3) Vehicle Maintenance: Ensure material handling equipment and

vehicles are in a serviceable condition prior to the Pacer Goose shipping season.

d. The MSC Representative will:

- (1) Act as liaison between the U.S. Air Force, Greenland O&M Contractors, and ship masters.
- (2) Assist in enforcement of shore liberty policy, with respect to civilian crews of vessels controlled by MSC and US Coast Guard (USCG).
- (3) Coordinate port activities with the Port Operations Superintendent.
- (4) Advise Port Operations Monitor of ship arrivals and departures.

e. Base Civil Engineer will:

- (1) Prior to the part season inspect and repair the DeLong Pier, causeway and all structures including lights and heating facilities.
- (2) Furnish vehicle traffic signs as required.
- (3) Ensure freeze and chill commissary warehouses are operational.
- (4) Remove polynya system prior to arrival of the first ship. Replace polynya system before ice forms around the pier.
- (5) Deliver water for ships servicing as required.

f. GC Communications will:

- (1) Conduct a pre-operations survey with Port Operations Superintendent to determine operational dates of services required.
- (2) Maintain telephone service for port operations. Provide ship-to-shore telephone for ships in port and place such telephones aboard ship as indicated by ship's master.
- (3) Provide port operations with intrabase radio equipment as requested by the Port Superintendent. AF Form, 3215, Local Communication Requests, will be submitted for all communications requirements. The AF Form 3215 for intrabase radio equipment will be submitted one month in advance.
- (4) Maintain MSC radios.
- (5) Maintain a wind transmitter at building #992.
- (6) Provide weather forecast on a daily basis to the Port

Superintendent and advise him of any on/off base weather warnings.

g. FSI will:

- (1) Receive and transmit official messages when official authorization and releasing signatures have been verified by Ship's Master. All messages must be delivered by the releasing agency, to the Base Communications Center, building #112.
- (2) Provide data processing capability for MILSTAMP requirements for the Port Documentation Section including DD Form 1384, Transportation Control and Movement Documents (TCMDs) and cargo manifests.

h. KALAALLIT NIUERFIAT (KNI) Representative will:

- (1) Provide the Port Operations Monitor and Port Operations Superintendent with one copy each of manifests for Danish ships which are to be offloaded.
- (2) Notify the Port Superintendent of expected date and time of Danish/Greenlandic ship arrivals.
- (3) Provide ship side representative to identify and receive Danish cargo.

i. Base Photo Lab will:

- (1) Take pictures of damaged cargo.
- (2) Take pictures of special events to supplement after-action report.

j. All consignees will:

- (1) Designate specific points for delivery of cargo and identify for each line item on the manifest the individuals authorized to receipt for the cargo.
- (2) Accomplish re-warehousing prior to Pacer Goose, to ensure uninterrupted acceptance of inbound cargo. Truck wells of all warehouses will be cleared prior to port opening.
- (3) Acknowledge the receipt of cargo by signing the TCMDs.
- (4) Insure that all equipment such as chains, pallets and tie-downs, are backloaded on trailers prior to pick-up by the Port Clearance Section.
- (5) Furnish a dockside representative for identification of cargo if requested by the Port Operations Monitor or Port Superintendent.
- (6) Be prepared to receive cargo on a 24-hour basis with minimum

notice and provide personnel necessary to perform expeditious offloading of cargo.

(7) Procure lumber required through base supply for storage or stacking of incoming cargo in accordance with existing supply procedures.

(8) Organizations that have retrograde shipments for CONUS will notify Port Operations NLT 30 days prior to scheduled ship arrivals to allow for processing of documentation to Traffic Management Office (GC/LGTT).

(9) If receiving arms, ammunition or explosives organizations must provide secure storage of these items NLT 12 hours after off-load.

1.1.2 Port Security Procedures

- a. Greenland Contractors Port Superintendent (GC/LGTP) responsibilities. Routinely monitor vehicles attempting to enter the port. Vehicles not directly associated with the port operations, as determined by the Port Superintendent and Port Operations Monitor, are not authorized.

NOTE: Base taxis will off-load passengers at the entry point and will not proceed onto the dock. Shuttle buses will off-load passengers at the entry point, but may proceed onto the pier to facilitate turnaround. Buses transporting stevedores to/from pier any proceed to the stevedores shack. All passenger-carrying vehicles will maintain a safe distance from cargo offloading operations.

- b. GC Civil Engineers (GC/DEC) responsibilities. Erect barricades across entry point access road when directed by the Port Superintendent or Port Operations Monitor to restrict traffic to the port area.

- c. Security Police responsibilities.

(1) A patrol will make routine checks of the port area every two hours or whenever required by the Port Superintendent or the Port Operations Monitor.

(2) During offloading of ammunition or explosives, manned posts will be located as necessary when required.

1.1.3 Stevedoring and Port Clearance

- a. Documentation.

(1) The documentation section will receive Ocean Cargo Manifest and stowage plans via AUTODIN or airmail and prepare as necessary.

(2) Consignees will receive one copy of the manifest and enter delivery instructions consisting of building number for delivery

and possible special instructions.

b. Initial inspection after ships arrival.

(1) The MSC Representative will make a survey to determine if there is illness on board, general condition of the ship and its cargo, special mooring requirements, etc.

(2) The Port Superintendent and the Port Operations Monitor will accompany the ship's representative through the holds to identify any damage or pilferage when hatches are opened.

c. Off-loading Operations.

(1) The stevedoring contractor will unload ships' cargo onto trailers where practical.

(2) The cargo checker will identify each piece of cargo against appropriate TCN and receipt for the cargo on the TCMD. The cargo checker will retain copy #2 of the TCMD and give the remaining copies to the driver, who in turn will receipt for the cargo.

(3) The cargo checker's copy of the TCMD will be delivered to the Documentation Section to clear the manifest and prepare Cargo Outturn Report.

(4) The truck drivers will deliver the cargo and TCMD to the consignee as directed by Port Clearance Section.

(5) The truck driver will obtain consignee signatures on the first carbon copy of the TCMD as a receipt for the cargo. This copy will be returned to the Documentation Section.

(6) Consignee will report discrepancies (over/short) shown on the manifest or TCMD within 48 hours after discharging has been completed.

(7) Consignees are responsible for having sufficient personnel available to offload trailers with minimum delay, normally 12 hours per day; however, 24-hour operation may be required at times.

(8) The staging area east of building #987 will be used for temporary storage of cargo that cannot be delivered immediately to warehouses.

(9) Unidentifiable cargo will be delivered to Traffic Management Office (TMO) Hangar #7, for necessary research and final delivery.

d. Inbound Cargo, KNI.

(1) Upon vessel's departure from Denmark, KNI Representative at Thule will request shipping information (total load, stow location, ETA Thule, etc). The KNI Representative will deliver three (3) copies of the shipping documents to the Port

Superintendent at least five working days prior to ships arrival.

(2) All cargo will be issued on TCMDs and hauled to designated location.

(3) KNI will arrange for its own damage/short/loss reports and necessary photos.

e. Retrograde Cargo, MSC.

(1) Retrograde cargo will be delivered by the consignor to a staging area indicated by the Port Superintendent. Each lot of cargo will be documented using DD Form 1149, Requisition and Invoice /Shipping Document or DD Form 1348?1, DOD Single Line Item Requisition System Document, in five (5) copies.

(2) Shipping documents Will be prepared for each different commodity.

(3) DRMO will insure that vehicles are prepared for shipment in accordance with applicable technical orders. As a minimum FUEL TANKS MUST BE DRAINED and BATTERY CABLES DISCONNECTED.

(4) Retrograde cargo will be packed, crated, marked and/or documented in accordance with DODR-4500?32, Vol. I (MILSTAMP) and/or other pertinent directives.

(5) Port Operations (Documentation Section) will develop local procedures for documenting retrograde cargo.

1.1.4 Site Resupply

- a. The 1012 ABG/LG will supervise and coordinate resupply operations through the Site Resupply Office (1012 ABG/LGT).
- b. Canadian Stations Alert and Eureka: Cargo discharged at Thule for these stations will be secured pending airlift by Canadian Armed Forces or sealift by other Canadian vessel.
- c. Scientific Expeditions: Cargo received for scientific expeditious will be moved to Traffic Management Office (IMO), Hangar #7, for processing.

1.1.5 Base Supply

Processing of vehicles received an sealift.

- a. Upon receipt of a vehicle, Base Supply Receiving Section (BEMO), will be notified by the Documentation Section. Base Supply Receiving Section will receipt for vehicles and receive documentation for processing (DD Form 1384).
- b. Vehicles will be moved to Vehicle Maintenance, Bldg #580 and held for initial inspection, operational servicing and acceptance

inspection (LTI).

1.1.6 Tanker Discharge

a. POL Responsibilities

- (1) Prepare schedule for discharge of tanker cargo into pre-selected on-shore receiving tanks. Preposition pipeline, manifold and receiving tank control valves, preliminary to tanker discharge.
- (2) Perform pre-acceptance and post-discharge inspection of tanker cargo for quality and quantity control.
- (3) Operate on-shore POL facilities to control delivery of bulk fuels into designated tanks.
- (4) Coordinate with Liquid Fuels Maintenance (Civil Engineering Department) on pre- and post-discharge inspection of sea hose and evaluation of repairs and replacement parts needed for subsequent years resupply operations.
- (5) Ensure timely submission of reports applicable to each tanker discharge.

b. Responsibilities of CE Liquid Fuels Maintenance.

- (1) Inspect and repair as necessary all tank fittings such as vents, visual gauge fittings, relief valves and static ground connections.
- (2) Accomplish tank inspections and cleaning operations, as necessary.
- (3) Maintain serviceability of shore connections, clean flanges and replace gaskets. Clean dirt from lines, valves and fittings. Renew all old or used gaskets and ensure availability of sufficient supply of spares.
- (4) Clean and inspect shore valves. Lubricate, repair and operate valves to ensure they are serviceable.
- (5) Inspect pipelines from pier connections to storage tanks. Repair flanges, fittings and replace gaskets as required. Replace /repair broken pipe supports and anchors.
- (6) Pre-assemble POL sea hoses on DeLong Pier and pressure test assembled hoses (two lines) to minimum 120 psi. Inspect lines under pressure (Fuels Management Representative will witness), connect to onshore pipe lines, place sea hoses in water and perform subsequent maintenance and repair of sea hoses as required.
- (7) Inspect the contamination boom prior to tanker operation.

c. Port Operations.

- (1) Position ship and sea hoses and assist ship's crew as necessary in rigging and securing sea hoses. Remove sea hoses upon completion of discharge.
- (2) Maintain water taxi service on a 24-hour basis during discharge operations for Fuels Management personnel as required, and to protect POL sea hoses from encroachment of icebergs.

d. Packaged POL.

- (1) The Fuels Management Superintendent will receive copies of tanker schedules indicating cargo, quantities, and ETA. Tankers will give the Fuels Management Superintendent four (4) copies of DD Form 250-1, Tanker/Barge Material Inspection and Receiving Report.
- (2) Fuels Management will initiate messages and reports pertinent to Tanker Discharge, in accordance with DOD Manual 4140-25M requirements.
- (3) Operate on-shore POL facilities to control delivery of bulk fuels into designated tanks.
- (4) When tanker is discharging, Fuels Management will inform port documentation section each morning of quantities received during the last 24 hours.

1.1.7 General Safety Regulations for DeLong Pier

- a. The DeLong Pier is designated as a limited access area during port season.
- b. The Port Superintendent has the right to, at any time, refuse entry to all non-essential personnel.
- c. Safety helmets will be used as directed by the Port Superintendent.
- d. Vehicles will keep left when driving on the pier.
- e. Vehicles will be parked only in areas specified by the Port Superintendent.
- f. Smoking and open fires are forbidden, except in posted authorized smoking areas.
- g. Smoking will be permitted aboard vessels only as designated by the ship's master.

1.1.8 Special Regulations for Discharging Tankers

- a. Only personnel directly involved with tanker discharging will

operate in the vicinity of such operations.

- b. Personnel involved with tanker discharging operations will deposit lighters, and other flammable devices' in the Port Operations Office, Bldg #992. Footwear must not be of a design which any cause sparks.
- c. All open fires in offices, break areas and on the pier are forbidden. However, permanently installed and authorized heaters in such areas may be operated.

FOR THE COMMANDER

WAYNE M. GLASS, MSgt, USAF
Chief, Base Information Management

SUMMARY OF CHANGES

Royal Greenland Trade Department (RGTD) has been changed to KALAALLIT NIUERFIAT (KNI). Controlled area monitor and signs are no longer required. Consignees will receive only one copy of the cargo manifest. Five copies of the TCMD are no longer required. Subsistence procedures are deleted.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 00902

TRANSPORTATION FACILITIES AND ACTIVITIES REIMBURSABLE EXPENSES
03/02

PART 1 GENERAL

1.1 GENERAL

This regulation establishes rates and charges for terminal services, facilities, and supplies furnished to commercial aircraft, commercial vessels and shippers which are authorized handling at aerial or water ports on a reimbursable basis. It applies to all personnel assigned or attached to the 12 MWS and the 1012 and 1015 ABGs involved in water port activities at Thule and Sondrestrom Air Bases.

1.1.1 Terms Explained

- a. Reimbursable Revenue Cargo. Cargo for which monetary charges must be levied in accordance with the rates established herein. This cargo includes:
 - (1) Cargo owned by a "government contractor" whose contract does not provide for handling at the port at government expense.
 - (2) Cargo transported where the terms of sale require reimbursement to the government for services, facilities, or supplies furnished.
- b. Obligor. The individual firm, corporation, or other entity responsible for paying monetary charges as billed.
- c. US Government. The Government of the United States of America.
- d. Commander. The commander of Thule Air Base or Sondrestrom Air Base, as applicable, or the duly authorized representatives.
- e. Commercial Vessel. Any vessel other than a Military Sealift Command (MSC) vessel, a US Navy vessel, or a US Coast Guard vessel.

1.1.2 Responsibilities

- a. The USAF base transportation officer exercises surveillance over the provisions contained herein and makes sure billing information is furnished to the accounting and finance office on a timely basis for billing purposes.
- b. Stevedoring contractor or supervisors will familiarize themselves with the contents of this regulation and make sure billing is done and submitted in the prescribed format before departure of vessel.

1.1.3 Charges

- a. Charges will be levied for reimbursable services rendered, as directed by a duly authorized person. Normally, reimbursable revenue cargos will comprise only three categories of obligors.
 - (1) Commercial vessels.
 - (2) US Army Engineer, North Atlantic Division, contractors or subcontractors.
 - (3) Buyers of US Government foreign excess property.
- b. A single shipment may require the billing of two obligors, for example certain services may be billed to the commercial vessel and other items to the shipper.
- c. Situations may arise where the above three categories do not cover the obligor. In such cases, the stevedoring contractor coordinates with the USAF base transportation officer concerning procedures to be followed.

1.1.4 Changes in Rates

In cases of cargo requiring special handling or when items are furnished beyond the scope of items for which rates or charges are herein established the charge will be based upon actual cost to the government. The current government price as quoted by the USAF base supply officer at the time supplies are furnished will be used plus a 35 percent overhead charge. Charges for POL products will be determined on each individual case by HQ USAF via HQ AFSPACECOM/LKTT.

1.1.5 Acceptance of the Vessel Operator

The placing on berth of a vessel will constitute acceptance by the vessel operator of the rates, charges, and provisions of this regulation for any services, facilities or supplies furnished by the terminal for the account of such vessel. A request for payment of a bill to the vessel operator for services, facilities, or supplies furnished hereunder by the accounting and finance officer of the base will be accepted by the vessel operator as a proper allocation by the US Government of all charges and the amount billed will be a matter strictly between the vessel operator and the shipper.

1.1.6 Priority of Military Cargo Operations

The handling of cargo for the account of the vessel or vessels shipped will not be permitted to interfere with military cargo operations. When the USAF port commander determines and notifies the vessel that the presence on berth of the vessel or the loading /unloading of the vessel (or both) interferes with military cargo operations, the master of the vessel is obligated, at the expense of the vessel, to cease all loading/unloading or other activity in the terminal area, remove any and all obstructions or interferences which are a responsibility of the vessel, and move the vessel

away from the berth a sufficient distance to avoid interference with military cargo operations. Neither the vessel nor the shipper is vested with any right to reimbursement under this regulation because of delay, inconvenience, or expense incurred because of having to yield to military cargo operation. The vessel operator will obtain cargo receipts and other cargo documentation directly from the shipper.

1.1.7 Customs, Taxes and Duties

The US Government has no responsibility for payment of taxes, duties, or other such charges on account of any cargo handled or services, facilities or supplies furnished hereunder.

1.1.8 Tonnages

The computation of weight, when weight is not otherwise reliably available, will be determined from computation of the change in the displacement of the vessel, which will be calculated by the port operator, the master of the vessel, and the shipper or their authorized representatives. The computation of measurement tonnage, will be made by the USAF base transportation officer.

1.1.9 Condition of Vessel, Cargo, and Cargo Handling Gear

The vessel operator will verify with the shipper and be satisfied that all cargo, except as specifically described in writing before loading/discharge is within capability of ship's gear. The vessel operator assumes the liability for, and risk of damage to, cargo and/or vessel arising out of or in connection with the navigation or operation of the ship or the loading, carriage, or discharge of cargo from other than gross negligence or willful acts by the United States Government personnel. The vessel operator makes sure that the vessel is prepared to receive and/or discharge. The vessel operator will certify that none of the cargo is hazardous and that where cargo is marked as to weight, dimensions, or special handling, it is properly marked and will accept responsibility for the accuracy of such marking.

1.1.10 Stevedoring Rates

Rates for loading and for discharging cargo are given in schedule 1, attachment 1, and apply to stevedoring, including winch operators, hatch foreman and the like. Stevedoring rates do not include handling of cargo outside the immediate port area. Classification of cargo according to the categories given in schedule 1 will be done by the port operator.

1.1.11 Delivery Rates and Charges

The type of cargo and the delivery charges and/or rates are given in schedule 1, (attachment 1). Delivery covers land transportation or land movement of the cargo outside the terminal area. Delivery may be done by towing, driving, or hauling, according to the decisions of the commander. Mileage is computed from the boundary of the terminal area to the point of delivery or pickup. No delivery or pickup will be made for a distance greater than 15 miles from the boundary of the port area. The US

Government will undertake delivery of cargo under this regulation only when authorized by contract or an authorized representative of the US Government.

1.1.12 Equipment Rates

Equipment rental rates exclude operators and are given in Schedule 2, attachment 2. Equipment is only operated by base personnel, except with specific written approval of the commander, which will be attached to and become part of the file as it applies to a particular operation. When equipment is operated by non-base personnel, they are under the supervision of the terminal operator. Further, the vessel operator or shipper will be responsible for any damage other than fair wear and tear caused to such equipment during the period it is so operated. The port operator has authority without liability to refuse to permit terminal equipment to be operated by vessel or shipper personnel and to terminate such at anytime. The vessel operator accepts the risks inherent in the use of harbor craft, and so claim will lie against the US Government or its personnel for any bumping, denting, or scraping of paint or other minor damage to the vessel not resulting from gross negligence or willful act of harbor craft operator.

1.1.13 Supplies

Lashing and dunnage will normally be supplied by the vessel. Such items may be supplied by the US Government after the vessel has exhausted its supply and presents satisfactory proof that no supplies are elsewhere available to the vessel. The rates for lashing and dunnage will be the current price quoted by the base supply officer at the time items are furnished, plus a 35 percent overhead charge.

1.1.14 Labor and Equipment Operators

(Labor rates are given in schedule 2, (attachment 2). When labor is supplied, such as equipment operators (the term equipment operators includes truck drivers, crane operators, water craft operators, etc): marine carpentry (the term marine carpentry, includes the lashing, dunnaging or shoring of cargo over and above normal stevedoring for which no cargo handling charge was made hereunder): or for shifting of cargo for the benefit of the vessel, the rate will be 200 DDK per hour per individual, including supervisory personnel directly employed at the site of the work. Any labor expended by the terminal for line handling to make the vessel ready to receive or discharge cargo, such as removing the deck cargo to get at hold cargo, replacing same, and removing debris, supplies or dunnage, or other items from the vessel to permit proper loading/discharge, will be charged under this clause.

OFFICIAL

G. A. STANSELL
Colonel; USAF
Director of Administration

SUMMARY OF CHANCES

Deletes NORAD in the heading and updates office symbols.

ROBERT T. HERRES
General, USAF
Commander

2 Attachments

1. Schedule 1. Rates for Loading and Discharging Cargo
2. Schedule 2. Equipment Rental Rates

SCHEDULE 1. RATES FOR LOADING AND DISCHARGING CARGO

COMMODITIES	DISCH RATE	LOADING RATE	RATE PER TON/MILE)
GENERAL, including boxed scrap Banded lumber, plasterboard, and all commodities not listed (per MTON** or MFCT***)	9.20	13.35	1.70
CEMENT, (per LTON* or MFCT)	12.00	15.20	1.30
DRUMS, empty (per MTON or MFCT)	11.05	6.40	.80
DRUMS, full (other than tar) (per MTON or MFCT)	11.05	13.35	1.30
LUMBER, loose (per LTON or MFCT)	22.00	26.70	1.70
PENALTY, including explosives, drummed tar; steel, scrap vehicles, creosoted pole, scrap (loose wood or metal), pipe (concrete or metal), culverts, ammunition, and any other obnoxious or difficult to handle cargo (per LTON or MFCT)	15.20	19.75	1.70
REFRIGERATED, (per LTON or MFCT)	13.85	17.90	1.70
			DELIVERY CHARGE (15 mile limit)
CARS, passenger; TRAILERS, small TRUCKS, small (less than 1-ton Capacity) (Each)	56.15	58.00	37.80
TRUCKS, medium (1 1/2 ton cap) SEMI-TRAILERS; TRAILERS (Each)	79.50	98.00	79.50
TRUCKS, Medium (3-ton cap) loaded with 1 1/2 tons of salvage material	_____	_____	_____
TRUCKS, large (over 3-ton cap)	_____	_____	_____
TRUCKS, dump, large	119.50	119.50	

SCHEDULE 1. RATES FOR LOADING AND DISCHARGING CARGO

TRUCKS, large(over 3-ton cap)
loaded with salvage material
equaling 1/2 of rated capacity) _____

MACHINERY, (snowplows, bulldozers, 139.80 158.00
Road graders, etc.)

*LTON - Long Ton, 2240 pounds

**MTON - Measurement ton, 40 cubic feet

***MFCT - Major Fractional Component Thereof

SCHEDULE 2. EQUIPMENT RENTAL RATES

EQUIPMENT	RENT/HR	MIN. RENT
5 ea 15 cy dumpers	\$20.00	\$40.00
5 ea, front end loaders (various sizes)	17.00	34.00
3 ea dozers	30.00	112.00
1 ea traskevator	30.00	112.00
4 ea graders	30.00	112.00
1 ea excavator	30.00	112.00
1 ea 50 ton hydr. crane	29.00	87.00
1 ea 60 ton hydr. crane	29.00	87.00
2 ea tractor/trailer	14.00	42.00

Listed equipment may be rented as available. The Government reserves the right to withdraw equipment at any time during the rental period.

Manpower.

No equipment will be rented unless qualified operators are available. When crews are required, equipment will be manned in accordance with standards established by the base O&M contract.

Hourly rate to be charged for manpower is is 200 DDK per hour. Charges will be calculated in whole hours. Example: When a person works 1 hr and 15 min then 2 hours will be charged - or 400 /DDK.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 01312A

QUALITY CONTROL SYSTEM (QCS)
(NYD VERSION 09/01)

1.1 GENERAL

The Government will use the Resident Management System for Windows (RMS) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS, referred to as QCS, to record, maintain, and submit various information throughout the contract period. This joint Government-Contractor use of RMS and QCS will facilitate electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

- Administration
- Finances
- Quality Control
- Submittal Monitoring
- Scheduling
- Import/Export of Data

1.1.1 Correspondence and Electronic Communications

For ease and speed of communications, both Government and Contractor will, to the maximum extent feasible, exchange correspondence and other documents in electronic format. Correspondence, pay requests and other documents comprising the official contract record shall also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

1.1.2 Other Factors

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", Section 01320A, PROJECT SCHEDULE, Section 01330, SUBMITTAL PROCEDURES, and Section 01451A, CONTRACTOR QUALITY CONTROL, which have a direct relationship to the reporting to be accomplished through QCS. Also, there is no separate payment for establishing and maintaining the QCS database; all costs associated therewith shall be included in the contract pricing for the work.

1.2 QCS SOFTWARE

QCS is a Windows-based program that can be run on a stand-alone personal computer or on a network. The Contractor shall be responsible after award of the construction contract to download the QCS software and User Manual from the Government's RMS Internet website (<http://winrms.usace.army.mil>).

Prior to the Pre-Construction Conference, the Contractor shall be responsible to download, install and use the latest version of the QCS

software from the Government's RMS Internet Website. Any program updates of QCS will be made available to the Contractor via the Government RMS website as they become available and the Contractor shall be required to install and use the latest version of the QCS Software (Expect approximately eight (8) program updates per year).

1.3 SYSTEM REQUIREMENTS

The following listed hardware and software is the minimum system configuration that the Contractor shall have to run QCS:

Hardware

IBM-compatible PC with Pentium IV Pentium or higher processor (450Mhz)

256+ MB RAM

40 GB hard drive disk space for sole use by the QCS system

3 1/2 inch high-density floppy drive

24X CD/RW Drive

Color monitor

Laser printer compatible with HP LaserJet IV or better, with minimum 4 MB installed memory.

Connection to the Internet, minimum 28 BPS

Software

MS Windows 97 or newer version operating system (MS Windows 2000 or newer is recommended)

Word Processing software - MS Word 97 or newer

Internet browser

The Contractor's computer system shall be protected by virus protection software that is regularly upgraded with all issued manufacturer's updates throughout the life of the contract.

Electronic mail (E-mail) compatible with MS Outlook with minimum 5MB Storage Capacity

1.4 RELATED INFORMATION

1.4.1 QCS User Guide

After contract award, the Contractor shall download instructions for the installation and use of QCS from the Government RMS Internet Website ("<http://winrms.usace.army.mil/>");

1.5 CONTRACT DATABASE

Prior to the pre-construction conference, the Government shall provide the Contractor with basic contract award data to use for QCS. The Government will provide data updates to the Contractor as needed, generally by files attached to E-mail. These updates will generally consist of submittal reviews, correspondence status, QA comments, and other administrative and QA data.

1.6 DATABASE MAINTENANCE

The Contractor shall establish, maintain, and update data for the contract in the QCS database throughout the duration of the contract. The Contractor shall establish and maintain the QCS database at the Contractor's site office. Data updates to the Government shall be submitted by E-mail with file attachments, e.g., daily reports, schedule updates, payment requests. If permitted by the Contracting Officer, a data diskette or CD-ROM may be used instead of E-mail (see Paragraph DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM). The QCS database typically shall include current data on the following items:

1.6.1 Administration

1.6.1.1 Contractor Information

The database shall contain the Contractor's name, address, telephone numbers, management staff, and other required items. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver Contractor administrative data in electronic format via E-mail.

1.6.1.2 Subcontractor Information

The database shall contain the name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor must be listed separately for each trade to be performed. Each subcontractor/trade shall be assigned a unique Responsibility Code, provided in QCS. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver subcontractor administrative data in electronic format via E-mail.

1.6.1.3 Correspondence

All Contractor correspondence to the Government shall be identified with a serial number. Correspondence initiated by the Contractor's site office shall be prefixed with "S". Letters initiated by the Contractor's home (main) office shall be prefixed with "H". Letters shall be numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C".

1.6.1.4 Equipment

The Contractor's QCS database shall contain a current list of equipment planned for use or being used on the jobsite, including the most recent and

planned equipment inspection dates.

1.6.1.5 Management Reporting

QCS includes a number of reports that Contractor management can use to track the status of the project. The value of these reports is reflective of the quality of the data input, and is maintained in the various sections of QCS. Among these reports are: Progress Payment Request worksheet, QA/QC comments, Submittal Register Status, Three-Phase Inspection checklists.

1.6.2 6.2 Finances

1.6.2.1 Pay Activity Data

The QCS database shall include a list of pay activities that the Contractor shall develop in conjunction with the construction schedule. The sum of all pay activities shall be equal to the total contract amount, including modifications. Pay activities shall be grouped by Contract Line Item Number (CLIN), and the sum of the activities shall equal the amount of each CLIN. CLINs may include multiple activities, but activities may be assigned to only one such CLIN item. The total of all CLINs equals the Contract Amount.

1.6.2.2 Payment Requests

All progress payment requests shall be prepared using QCS. The Contractor shall complete the payment request worksheet and include it with the payment request. The work completed under the contract, measured as percent or as specific quantities, shall be updated at least monthly. After the update, the Contractor shall generate a payment request report using QCS. The Contractor shall submit the payment requests with supporting data by E-mail with file attachment(s). If permitted by the Contracting Officer, a data diskette may be used instead of E-mail. A signed paper copy of the approved payment request is also required, which shall govern in the event of discrepancy with the electronic version.

1.6.3 Quality Control (QC)

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other contractor QC requirements. The Contractor shall maintain this data on a daily basis. Entered data will automatically output to the QCS generated daily report. The Contractor shall provide the Government a Contractor Quality Control (CQC) Plan within the time required in Section 01451A, CONTRACTOR QUALITY CONTROL. Within seven calendar days of Government acceptance, the Contractor shall submit a data diskette or CD-ROM reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

1.6.3.1 Daily Contractor Quality Control (CQC) Reports.

QCS includes the means to produce the Daily CQC Report. The Contractor may use other formats to record basic QC data. However, the Daily CQC Report generated by QCS shall be the Contractor's official report. Data from any

supplemental reports by the Contractor shall be summarized and consolidated onto the QCS-generated Daily CQC Report. Daily CQC Reports shall be submitted as required by Section 01451A, CONTRACTOR QUALITY CONTROL. Reports shall be submitted electronically to the Government using E-mail or diskette within 24 hours after the date covered by the report. Use of either mode of submittal shall be coordinated with the Government representative. The Contractor shall also provide the Government a signed, printed copy of the daily CQC report.

1.6.3.2 Deficiency Tracking.

The Contractor shall use QCS to track deficiencies. Deficiencies identified by the Contractor will be numerically tracked using QC punch list items. The Contractor shall maintain a current log of its QC punch list items in the QCS database. The Government will log the deficiencies it has identified using its QA punch list items. The Government's QA punch list items will be included in its export file to the Contractor. The contractor will acknowledge receipt of these QA punch list items by specific number reference on the Daily CQC Report. The Contractor shall regularly update the correction status of both QC and QA punch list items.

1.6.3.3 Three-Phase Control Meetings

The Contractor shall maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

1.6.3.4 Accident/Safety Tracking.

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of the safety comments. In addition, the Contractor shall utilize QCS to advise the Government of any accidents occurring on the jobsite. This brief supplemental entry is not to be considered as a substitute for completion of mandatory reports, e.g., ENG Form 3394 and OSHA Form 200.

1.6.3.5 Features of Work

The Contractor shall include a complete list of the features of work in the QCS database. A feature of work may be associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

1.6.3.6 QC Requirements

The Contractor shall develop and maintain a complete list of QC Testing, Transfer Property Listings, Installed Property Listings, and User Training requirements in QCS, all tied to individual pay activities. The Contractor shall update all data on these QC requirements as work progresses, and shall promptly provide this information to the Government via QCS.

1.6.4 Submittal Management

The contractor will initially be required to enter all required submittal information into QCS. Thereafter, the Contractor shall maintain a complete list of all submittals, including completion of all data columns of ENG Form 4288, as required by Section 01330, SUBMITTAL PROCEDURES. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update, ENG Form 4288, shall be produced using QCS. RMS will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

1.6.5 Schedule

The Contractor shall develop a construction schedule consisting of pay activities, in accordance with Contract Clause "Schedules for Construction Contracts", or Section 01320A, PROJECT SCHEDULE, as applicable. This schedule shall be input and maintained in the QCS database either manually or by using the Standard Data Exchange Format (SDEF) (see Section 01320A PROJECT SCHEDULE). The contractor shall be responsible for ensuring the SDEF is in the format required to upload the data to QCS; otherwise, the contractor will be required to enter the data manually. The updated schedule data shall be included with each pay request submitted by the Contractor.

1.6.6 Import/Export of Data

QCS includes the ability to export Contractor data to the Government and to import Government-provided data.

1.7 IMPLEMENTATION

Contractor use of QCS as described in the preceding paragraphs is mandatory. The Contractor shall ensure that sufficient resources are available to maintain its QCS database, and to provide the Government with regular database updates. QCS shall be an integral part of the Contractor's management of quality control.

1.8 DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM

The Government-preferred method for Contractor's submission of updates, payment requests, correspondence and other data is by E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of computer diskettes or CD-ROM for data transfer. Data on the disks or CDs shall be exported using the QCS built-in export function. If used, diskettes and CD-ROMs will be submitted in accordance with the following:

1.8.1 File Medium

The Contractor shall submit required data on 3-1/2 inch double-sided high-density diskettes formatted to hold 1.44 MB of data, capable of

running under Microsoft Windows 95 or newer. Alternatively, CD-ROMs may be used. They shall conform to industry standards used in the United States. All data shall be provided in English.

1.8.2 Disk or CD-ROM Labels

The Contractor shall affix a permanent exterior label to each diskette and CD-ROM submitted. The label shall indicate in English, the QCS file name, full contract number, contract name, project location, data date, name and telephone number of person responsible for the data.

1.8.3 File Names

The Government will provide the file names to be used by the Contractor with the QCS software.

1.9 WEEKLY SUBMISSION OF EXPORT FILES

The contractor shall, at a minimum, generate and submit weekly export file to the Gov't.

1.10 MONTHLY COORDINATION MEETING

The Contractor shall update the QCS database each workday. At least monthly, the Contractor shall generate and submit an export file to the Government with schedule update and progress payment request. As required in Contract Clause "Payments", at least one week prior to submittal, the Contractor shall meet with the Government representative to review the planned progress payment data submission for errors and omissions. The Contractor shall make all required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will be returned. The Government will not process progress payments until an acceptable QCS export file is received.

1.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. The QCS module shall be completed to the satisfaction of the Contracting Officer prior to any contract payment (except for Bonds, and Insurance, as approved by the Contracting Officer).

-- End of Section --

SECTION 01320A

PROJECT SCHEDULE
Network Analysis System
NYD VERSION 08/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referenced in the text by basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1-1-11 (1995) Progress, Schedules, and Network
Analysis Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-12 Schedules

Initial Project Schedule; G
Preliminary Project Schedule; G
Periodic Project Schedule; G

Four copies of the schedules showing codes, values, categories, numbers, items, etc., as required.

SD-19 Statements

Qualifications; FIO

Documentation showing the qualifications of personnel preparing the reports.

SD-20 Reports

Narrative Report; FIO
Schedule Reports; FIO

Four copies of the reports showing numbers, descriptions, dates, float, starts, finishes, durations, sequences, etc., as required.

1.3 QUALIFICATIONS

The Contractor shall designate an authorized representative who shall be responsible for the preparation of all required project schedule reports. This person shall have previously created and reviewed computerized schedules. Qualifications of this individual shall be submitted to the Contracting Officer for review with the Preliminary Project Schedule submission.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS, a Project Schedule as described below shall be prepared. The Contractor shall be responsible for scheduling of all procurement and construction activities as well as design activities (such as in Design-Build projects) if applicable to the project. The scheduling of construction and design (if design-build project) shall be the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Subcontractors (including Designers if design-build project) and suppliers working on the project shall also contribute in developing and maintaining an accurate Project Schedule. The approved Project Schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis of all progress payments.

3.2 BASIS FOR PAYMENT

The schedule shall be the basis for measuring Contractor progress. Lack of an approved schedule or scheduling personnel will result in an inability of the Contracting Officer to evaluate Contractor's progress for the purposes of payment. Failure of the Contractor to provide all information, as specified below, shall result in the disapproval of the entire Project Schedule submission and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. In the case where Project Schedule revisions have been directed by the Contracting Officer and those revisions have not been included in the Project Schedule, the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until revisions to the Project Schedule have been made.

3.3 PROJECT SCHEDULE

The computer software system utilized by the Contractor to produce the Project Schedule shall be capable of providing all requirements of this specification. Failure of the Contractor to meet the requirements of this specification shall result in the disapproval of the schedule. Manual methods used to produce any required information shall require approval by the Contracting Officer.

3.3.1 Use of the Critical Path Method

The Critical Path Method (CPM) of network calculation shall be used to generate the Project Schedule. The Contractor shall provide the Project Schedule in the Precedence Diagram Method (PDM) or the Arrow Diagram Method (ADM).

3.3.2 Level of Detail Required

With the exception of the initial and preliminary schedule submission, the Project Schedule shall include an appropriate level of detail. Failure to develop or update the Project Schedule or provide data to the Contracting Officer at the appropriate level of detail, as specified by the Contracting Officer, shall result in the disapproval of the schedule. The Contracting Officer will use, but is not limited to, the following conditions to determine the appropriate level of detail to be used in the Project Schedule:

3.3.2.1 Activity Durations

Contractor submissions shall follow the direction of the Contracting Officer regarding reasonable activity durations. Reasonable durations are those that allow the progress of activities to be accurately determined between payment periods. A rule of thumb, that the Contractor should use, is less than 2 percent of all non-procurement activities' Original Durations are greater than 20 days.

3.3.2.2 Design and Permit Activities

Design and permitting activities, including necessary conferences and follow-up actions and design package submission dates, shall be integrated into the schedule if these items are applicable to the project.

3.3.2.3 Procurement Activities

Tasks related to the procurement of long lead materials or equipment shall be included as separate activities in the project schedule. Long lead materials and equipment are those materials that have a procurement cycle of over 90 days. Examples of procurement process activities include, but are not limited to: submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing.

3.3.2.4 Government Activities

Government and other agencies activities that could impact progress shall be shown. These activities include, but are not limited to: approvals, inspections, utility tie-in, Government Furnished Equipment (GFE) and notice to proceed for phasing requirements.

3.3.2.5 Workers Per Day

All activities shall have an estimate of the average number of workers per day that are expected to be used during the execution of the activity to produce the expected completion date. If no workers are required for an

activity, in the case of activities related to procurement, for example, then the activity shall be identified as using zero workers per day. The workers per day information for each activity shall be identified by the Workers Per Day Code.

3.3.2.4 Critical Activities

In addition to other activities as required to complete the project, the Progress Schedule shall include the following as separate line activities:

- a. Submission and approval of mechanical/electrical layout drawings.
- b. Submission and approval of O & M manuals.
- c. Submission and approval of as-built drawings.
- d. Submission and approval of 1354 data and installed equipment lists.
- e. Submission and approval of HVAC Testing and Balancing plan.
- f. HVAC Testing and Balancing and submission and approval of report.
- g. Submission and approval of HVAC Commissioning plan.
- h. HVAC Commissioning dates.
- i. Other Systems testing as required.
- j. Pre-final Inspection.
- k. Correction of punchlist for pre-final inspection.
- l. Final Inspection.

3.3.2.5 Responsibility

All activities shall be identified in the project schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the subcontracting firm, contractor work force, or government agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code.

3.3.2.6 Work Areas

All activities shall be identified in the project schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code.

3.3.2.7 Modification or Claim Number

Any activity that is added or changed by contract modification or used to justify claimed time shall be identified by a mod or claim code that

changed the activity. Activities shall not belong to more than one modification or claim item. The modification or claim number of each activity shall be identified by the Mod or Claim Number. Whenever possible, changes shall be added to the schedule by adding new activities. Existing activities shall not normally be changed to reflect modifications.

3.3.2.8 Bid Item

All activities shall be identified in the project schedule by the Bid Item to which the activity belongs. An activity shall not contain work in more than one bid item. The bid item for each appropriate activity shall be identified by the Bid Item Code.

3.3.2.9 Phase of Work

All activities shall be identified in the project schedule by the phases of work in which the activity occurs. Activities shall not contain work in more than one phase of work. The project phase of each activity shall be by the unique Phase of Work Code.

3.3.2.10 Category of Work

All Activities shall be identified in the project schedule according to the category of work which best describes the activity. Category of work refers, but is not limited, to the procurement chain of activities including such items as submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing. The category of work for each activity shall be identified by the Category of Work Code.

3.3.2.11 Feature of Work

All activities shall be identified in the project schedule according to the feature of work to which the activity belongs. Feature of work refers, but is not limited to, a work breakdown structure for the project. The feature of work for each activity shall be identified by the Feature of Work Code.

3.3.2.14 HVAC Testing, Balancing and Commissioning

If this contract contains requirements for Heating, Ventilation and Air Conditioning Testing and Balancing and Commissioning, these activities must be allocated sufficient time and personnel resources by the Contractor so that they can be accomplished within time allowed for project completion. These activities are necessary to assure detection of any deficiencies in the HVAC Systems and avoid warranty callbacks. Included for guidance at the end of this section is a flow chart (Figures 1 and 2) showing major activities and their chronological relationship to each other and to the Notice to Proceed and Contract Completion points. They are for guidance only - the Contractor shall refer to applicable specification sections for actual requirements for these activities.

3.3.3 Scheduled Project Completion

The schedule interval shall extend from NTP to the contract completion date.

3.3.3.1 Project Start Date

The schedule shall start no earlier than the date on which the NTP was acknowledged. The Contractor shall include as the first activity in the project schedule an activity called "Start Project". The "Start Project" activity shall have an "ES" constraint date equal to the date that the NTP was acknowledged, and a zero day duration.

3.3.3.2 Constraint of Last Activity

Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the critical path. The Contractor shall include as the last activity in the project schedule an activity called "End Project". The "End Project" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

3.3.3.3 Early Project Completion

In the event the project schedule shows completion of the project prior to the contract completion date, the Contractor shall identify those activities that have been accelerated and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. Contractor shall specifically address each of the activities noted in the narrative report at every project schedule update period to assist the Contracting Officer in evaluating the Contractor's ability to actually complete prior to the contract period.

3.3.4 Interim Completion Dates

Contractually specified interim completion dates shall also be constrained to show negative float if the early finish date of the last activity in that phase falls after the interim completion date.

3.3.4.1 Start Phase

The Contractor shall include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have an "ES" constraint date equal to the date on which the NTP was acknowledged, and a zero day duration.

3.3.4.2 End Phase

The Contractor shall include as the last activity in a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

3.3.4.3 Phase X

The Contractor shall include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X"

activity shall be logically tied to the earliest and latest activities in the phase.

3.3.5 Default Progress Data Disallowed

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual Start and Finish dates on the CPM schedule shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the Actual Start and Finish dates on the Daily Quality Control report for every in-progress or completed activity, and failure to ensure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. Updating of the percent complete and the remaining duration of any activity shall be independent functions. Program features which calculate one of these parameters from the other shall be disabled.

3.3.6 Out-of-Sequence Progress

Activities that have posted progress without all preceding logic being satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case approval of the Contracting Officer. The Contracting Officer may direct that changes in schedule logic be made to correct any or all out-of-sequence work.

3.3.7 Extended Non-Work Periods

Designation of Holidays to account for non-work periods of over 5 days shall not be allowed. Non-work periods of over 5 days shall be identified by addition of activities that represent the delays. Modifications to the logic of the project schedule shall be made to link those activities that may have been impacted by the delay to the newly added delay activities.

3.3.7 Negative Lags

Lag durations contained in the project schedule shall not have a negative value.

3.4 PROJECT SCHEDULE SUBMISSIONS

The Contractor shall provide the submissions as described below. The data disk, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

3.4.1 Preliminary Project Schedule Submission

The Preliminary Project Schedule, defining the Contractor's planned operations for the first 60 calendar days shall be submitted for approval within 10 calendar days after the NTP is acknowledged. The approved preliminary schedule shall be used for payment purposes not to exceed 60 calendar days after NTP.

3.4.2 Initial Project Schedule Submission

The Initial Project Schedule shall be submitted for approval within 40 calendar days after NTP. The schedule shall provide a reasonable sequence of activities which represent work through the entire project and shall be at a reasonable level of detail.

3.4.3 Periodic Schedule Updates

Based on the result of progress meetings, specified in "Periodic Progress Meetings," the Contractor shall submit periodic schedule updates. These submissions shall enable the Contracting Officer to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgement of the Contracting Officer or authorized representative is necessary for verifying the Contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made.

3.4.4 Standard Activity Coding Dictionary

The Contractor shall submit, with the Initial Project Schedule, a coding scheme that shall be used throughout the project for all activity codes contained in the schedule. The coding scheme submitted shall list the values for each activity code category and translate those values into project specific designations. For example, a Responsibility Code Value, "ELE", may be identified as "Electrical Subcontractor". Activity code values shall represent the same information throughout the duration of the contract. Once approved with the Initial Project Schedule submission, changes to the activity coding scheme must be approved by the Contracting Officer's Representative. The Contractor shall use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11, Appendix A. This exact structure is mandatory, even if some fields are not used.

3.5 SUBMISSION REQUIREMENTS

The following items shall be submitted by the Contractor for the initial submission, and every periodic project schedule update throughout the life of the project:

3.5.1 Data Disks

Two data disks containing the project schedule shall be provided. Data on the disks shall adhere to the Standard Data Exchange Format (SDEF) specified in ER 1-1-11, Appendix A.

3.5.1.1 File Medium

Required data shall be submitted on 3.5 disks, formatted to hold 1.44 MB of data, under the MS-DOS Version 5. or 6.x, unless otherwise approved by the Contracting Officer.

3.5.1.2 Disk Label

A permanent exterior label shall be affixed to each disk submitted. The label shall indicate the type of schedule (Initial, Update, or Change), full contract number, project name, project location, data date, name and telephone number or person responsible for the schedule, and the MS-DOS version used to format the disk.

3.5.1.3 File Name

Each file submitted shall have a name related to either the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will ensure that the names of the files submitted are unique. The Contractor shall submit the file naming convention to the Contracting Officer for approval.

3.5.2 Narrative Report

A Narrative Report shall be provided with each update of the project schedule. This report shall be provided as the basis of the Contractor's progress payment request. The Narrative Report shall include: a description of activities along the 4 most critical paths, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. The narrative report is expected to relay to the Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through that analysis.

3.5.3 Approved Changes Verification

Only project schedule changes that have been previously approved by the Contracting Officer shall be included in the schedule submission. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

3.5.4 Schedule Reports

The format for each activity for the schedule reports listed below shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float. Actual Start and Actual Finish Dates shall be printed for those activities in progress or completed.

3.5.4.1 Activity Report

A list of all activities sorted according to activity number or "I-Node" or "J-Node" and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort.

3.5.4.2 Logic Report

A list of Preceding and Succeeding activities for every activity in

ascending order by activity number and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort.

3.5.4.3 Total Float Report

A list of all activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates.

3.5.4.4 Earnings Report

A compilation of the Contractor's Total Earnings on the project from the NTP until the most recent Monthly Progress Meeting. This report shall reflect the Earnings of specific activities based on the agreements made in the field and approved between the Contractor and Contracting Officer at the most recent Monthly Progress Meeting. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining Contractor Payment. Activities shall be grouped by bid item and sorted by activity numbers. This report shall: sum all activities in a bid item and provide a bid item percent; complete and sum all bid items to provide a total project percent complete. The printed report shall contain, for each activity: Activity Number or "I-Node" and "J-Node", Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), and Earnings to Date.

3.5.4.5 Labor Loading

For each activity shown on the logic report list the total amount of work required for the activity in man-hours, the number of workers assigned to the activity, the expected production rate for a worker, and the length of time (in work days) required to render the expected completion date for the activity. Completion dates on this report must agree with those on the logic report.

3.5.5 Network Diagram

The network diagram shall be required on the initial schedule submission and on bi-monthly (60 days) schedule update submissions. In addition to other submission requirements, a single mylar reproducible 20 inch by 30 inch size shall be submitted. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. The activity number, description, duration, and estimated earned value shall be shown on the diagram.

3.5.5.2 Project Milestone Dates

Dates shall be shown on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.5.3 Critical Path

The critical path shall be clearly shown.

3.5.5.4 Banding

Activities shall be grouped to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

3.5.5.5 S-Curves

Earnings curves showing projected early and late earnings and earnings to date.

3.6 PERIODIC PROGRESS MEETINGS

Progress meetings to discuss payment shall include a monthly onsite meeting or other regular intervals mutually agreed to at the preconstruction conference. During this meeting the Contractor shall describe, on an activity by activity basis, all proposed revisions and adjustments to the project schedule required to reflect the current status of the project. The Contracting Officer will approve activity progress, proposed revisions, and adjustments as appropriate.

3.6.1 Meeting Attendance

The Contractor's Project Manager and Scheduler shall attend the regular progress meeting.

3.6.2 Update Submission Following Progress Meeting

A complete update of the project schedule containing all approved progress, revisions, and adjustments, based on the regular progress meeting, shall be submitted not later than 4 working days after the monthly progress meeting.

3.6.3 Progress Meeting Contents

Update information, including Actual Start Dates, Actual Finish Dates, Remaining Durations, and Cost-to-Date shall be subject to the approval of the Contracting Officer. The following minimum set of items which the Contractor shall address, on an activity by activity basis, during each progress meeting.

3.6.3.1 Start and Finish Dates

The Actual Start and Actual Finish dates for each activity currently in-progress or completed .

3.6.3.2 Time Completion

The estimated Remaining Duration for each activity in-progress. Time-based progress calculations shall be based on Remaining Duration for each activity.

3.6.3.3 Cost Completion

The earnings for each activity started. Payment will be based on earnings for each in-progress or completed activity. Payment for individual activities will not be made for work that contains quality defects. A portion of the overall project amount may be retained based on delays of activities.

3.6.3.4 Logic Changes

All logic changes pertaining to NTP on change orders, change orders to be incorporated into the schedule, contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, lag durations, and other changes that have been made pursuant to contract provisions shall be specifically identified and discussed.

3.6.3.5 Other Changes

Other changes required due to delays in completion of any activity or group of activities are those delays beyond the Contractors control such as strikes and unusual weather. Also included are delays encountered due to submittals, Government Activities, deliveries or work stoppage which makes re-planning the work necessary, and when the schedule does not represent the actual prosecution and progress of the work.

3.7 REQUESTS FOR TIME EXTENSIONS

In the event the Contractor requests an extension of the contract completion date, he shall furnish such justification, project schedule data and supporting evidence as the Contracting Officer may deem necessary for a determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof of delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is obligatory to any approvals.

3.7.1 Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with this request.

The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in the extension of the schedule, will not be a cause for a time extension to the contract completion date.

3.7.2 Submission Requirements

The Contractor shall submit a justification for each request for a change in the contract completion date of under 2 weeks based upon the most recent schedule update at the time of the NTP or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

- a. A list of affected activities, with their associated project schedule activity number.
- b. A brief explanation of the causes of the change.
- c. An analysis of the overall impact of the changes proposed.
- d. A sub-network of the affected area.

Activities impacted in each justification for change shall be identified by a unique activity code contained in the required data file.

3.7.3 Additional Submission Requirements

For any requested time extension of over 2 weeks, the Contracting Officer may request an interim update with revised activities for a specific change request. The Contractor shall provide this disk within 4 days of the Contracting Officer's request.

3.8 DIRECTED CHANGES

If the NTP is issued for changes prior to settlement of price and/or time, the Contractor shall submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The proposed revisions to the schedule will be approved by the Contracting Officer prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor with suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until revisions are submitted, and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, the Contractor shall advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

3.9 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

-- End of Section --

((Add Figures 1 and 2- Flow Chart for HVAC Testing, Balancing and Commissioning)))

((ADD pages A1 through A14 "STANDARD DATA EXCHANGE FORMAT" from ER 1-1-11))))

SECTION 01330

SUBMITTAL PROCEDURES
(CENAN-CO-CQ 3/04)

PART 1 GENERAL

1.1 SUMMARY

This section covers procedures to be used in making submittals called for in the contract documents. In contracts which contain specific "Contractor Quality Control" requirements, the Contractor's Quality Control Representative shall carry out duties associated with submittal procedures.

In contract which do not contain specific CQC requirements, reference to "CQC Representative" shall be interpreted as reference to the Contractor's authorized representative, and references to "CQC Requirements" or "CQC Clauses" shall be interpreted as "requirements or clauses elsewhere in the contract."

1.2 SUBMITTAL IDENTIFICATION

Submittals required are identified by SD numbers and titles as follows:

SD-01 Preconstruction Submittals

A document, required of the Contractor, or through the Contractor, from a supplier, installer, manufacturer, or other lower tier Contractor, the purpose of which is to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality.

SD-02 Shop Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, details of fabrication, layouts of particular elements, connections, and other relational aspects of the work.

SD-03 Product Data

Preprinted manufacturer material describing a product, system, or material, such as catalog cuts.

SD-04 Samples

Samples, including both fabricated and un-fabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

SD-05 Design Data

Submittals, which provide calculations, descriptions, or documentation regarding the work.

SD-06 Test Reports

Reports of inspections or tests, including analysis and interpretation of test results.

SD-07 Certificates

Statement signed by an official authorized to certify on behalf of the manufacturer of a product, system or material, attesting that the product, system or material meets specified requirements. The statement must be dated after the award of the contract, must state the Contractor's name and address, must name the project and location, and must list the specific requirements, which are being certified.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material; including special notices and material safety data sheets, if any, concerning impedances, hazards, and safety precautions.

SD-10 Operation and Maintenance Data

Data, which forms a part of an operation and maintenance manual.

SD-11 Closeout Submittals

All data, documentations, information, and drawings to achieve contract closeout.

SD-12 Schedules

All data, documentations, information, and drawings to achieve contract closeout.

Documentation to record compliance with technical or administrative requirements.

1.3 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.3.1 Government Approved/Acceptance (G)

Government approval is required for all specification submittal items found in specifications having structural steel connections, extensions of design, Fire Protection/Life Safety, and Commissioning of HVAC, and other items as designated by the Contracting Officer. Government approval/acceptance (G) is also required for all submittals designated as such in the technical specifications. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings." The Government will review all submittals designated as deviating from the Solicitation or Accepted Proposal, as described below.

1.3.2 Information Only (FIO)

All Contractor submittals not requiring Government approval/acceptance will be for information only. FIO submittals are identified in the approved submittal register Form 4288. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above. FIO Submittals will be retained at the project site and reviewed prior to Preparatory Meetings in accordance with CEGS-01451, CONTRACTOR QUALITY CONTROL.

1.3.3 Government Approval/Acceptance (G)

All submittals classified for Government Approval/Acceptance (G) are identified in the approved submittal register Form 4288. A code following the "G" designation indicates the approving authority; codes of "RO" for Resident Office approval, "DO" for Engineering approval, and "AE" for Architect-Engineer approval.

1.4 APPROVED/ACCEPTANCE SUBMITTALS

The Contracting Officer's approval/acceptance of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.5 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

1.6 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

PART 2 PRODUCTS (Not used)

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall make submittals as required by the specifications.

The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) System Manager and each item shall be stamped, signed, and dated by the Contractor's Quality Control CQC System Manager indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

3.2 SUBMITTAL REGISTER (ENG FORM 4288)

At the end of this section is one set of ENG Form 3288 listing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals may be required. Columns "d" through "r" have been completed by the Government; the Contractor shall complete columns "a" "b" and "s" through "aa" and submit the forms (hard copy plus associated electronic file) to the Contracting Officer for approval within 30 calendar days after Notice to Proceed (15 days if construction time is 180 days or less). If the Quality Control System (QCS) Module is required to be utilized on this contract as required by Spec. Section 01312 Quality Control System, then the contractor will be required to process and update the 4288 electronically, and make appropriate electronic submissions to the Government. Otherwise, the Contractor shall enter the submittal register in an appropriate electronic format such as MS Excel, manually. In both cases, the Contractor shall update the 4288 electronically, and shall submit it to the Government together with the monthly payment request. The approved submittal register will become the scheduling document and will be used to control submittals throughout the life of the contract. The submittal register and the progress schedules shall be coordinated. NOTE: The Contractor is required to add additional entries to the Submittal Register for all items requiring multiple submittals, including Formwork Shop Drawings per Lift, Concrete Reinforcement per Lift, Concrete Lift Drawings per Lift, Multiple Shop Assembly Drawings, etc. These entries should be made prior to original submission of the submittal register within 30 days of Notice to Proceed.

3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings

shall be so scheduled. Adequate time (a minimum of 30 calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals. An additional 10 calendar days shall be allowed and shown on the register for review and approval of submittals for food service equipment, refrigeration and HVAC control systems, computer software for specialty systems, electrical substations, and studies including electrical system coordination studies.

3.4 TRANSMITTAL FORM (ENG FORM 4025)

The sample transmittal form (ENG Form 4025) attached to this section shall be used for submitting both Government approved/accepted and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

If the contractor is required in another section of the specifications to utilize the Quality Control System (QCS), the contractor will be required to generate and process this form electronically using the QCS System.

3.5 SUBMITTAL PROCEDURE

Submittals shall be made as follows:

3.5.1 Procedures

At the Quality Control Coordination meeting, or preconstruction conference, the Contractor shall ascertain the name and address of each individual, agency, or firm who is designated to normally receive items for approval, for information or samples. The contractor shall complete ENG Form 4025, entering each item requiring a separate approval action as a separate item on the form, for each transmittal. A transmittal may consist of one or more 4025 sheets. The transmittal, consisting of ENG Form 4025 plus all applicable submittals, is then sent to the appropriate individual. On critical items the Contractor is encouraged to confirm receipt via telephone. The Contractor shall submit seven copies of submittals for approval and one for items for information.

3.5.2 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

3.6 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure

that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

3.7 GOVERNMENT APPROVED/ACCEPTANCE SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval/acceptance by being so stamped and dated. Four copies of the submittal will be retained by the Contracting Officer and three copies of the submittal will be returned to the Contractor.

3.8 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

3.9 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACATOR (Firm Name)
<input type="checkbox"/> Approved
<input type="checkbox"/> Approved with corrections as noted on submittal data and/or attached sheet(s).
SIGNATURE: _____
TITLE: _____
DATE: _____

-- End of Section --

SUBMITTAL REGISTER

CONTRACT NO.
NY COE

TITLE AND LOCATION FY05 Replace Dormitory, Thule AB, Greenland						CONTRACTOR											
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
			Initial Project Schedule: G														
			Preliminary Project Schedule: G														
			Periodic Project Schedule: G														
			Qualifications: FIO														
			SD-01 Preconstruction Submittals														
			Environmental Protection Plan	1.7	G												
			SD-02 Shop Drawings														
			As-Built Drawing														
			SD-03 Product Data														
			As-Built Record of Equipment and Material														
			Warranty Management Plan	1.3.1													
			Warranty Tags	1.3.5													
			Final Cleaning	1.6													
			SD-03 Product Data														
			Tools	3.2.1.1													
			SD-07 Certificates														
			Demolition plan	1.10													
			C-101														
			SD-11 Closeout Submittals														
			Receipts	1.4.2													
			SD-03 Product Data														
			Utilization of Excavated Materials	3.8													
			Rock Excavation	1.5.2													
			Opening of any Excavation or Borrow Pit	3.3													

SUBMITTAL REGISTER

CONTRACT NO.
NY COE

TITLE AND LOCATION FY05 Replace Dormitory, Thule AB, Greenland						CONTRACTOR											
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02300	SD-06 Test Reports														
			Testing	3.14													
			Borrow Site Testing	2.1													
			SD-07 Certificates														
			Testing	3.14													
		02373	SD-03 Product Data														
			Thread	2.1.2													
			Manufacturing Quality Control	2.2													
			Sampling and Testing														
			SD-04 Samples														
			Quality Assurance Samples and Tests	3.1													
			SD-07 Certificates														
			Geotextile	2.1.1													
		02531	SD-02 Shop Drawings														
			Supports														
			Assembly techniques														
			SD-03 Product Data														
			Pipeline materials and supports	2.1													
		02554A	SD-02 Shop Drawings														
			Materials and Equipment	2.1													
			SD-03 Product Data														
			Materials and Equipment	2.1	G												
			Welding Procedures and Qualifications	1.4													

SUBMITTAL REGISTER

CONTRACT NO.
NY COE

TITLE AND LOCATION FY05 Replace Dormitory, Thule AB, Greenland						CONTRACTOR											
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)		DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)			A C T I O N C O D E (o)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02554A	SD-10 Operation and Maintenance Data														
			Distribution System	3.1.2.1	G												
		02722A	SD-03 Product Data														
			Plant, Equipment, and Tools	1.7													
			Waybills and Delivery Tickets														
			SD-06 Test Reports														
			Sampling and testing	1.5													
			Field Density Tests	1.5.2.4													
		03101A	SD-02 Shop Drawings														
			Shop Drawings	1.4													
			SD-03 Product Data														
			Materials	2.1													
			SD-04 Samples														
			Sample Panels	1.5	G G												
			SD-06 Test Reports														
			Inspection	3.3													
			Formwork Not Supporting Weight of Concrete	3.2.1	G												
		03200A	SD-02 Shop Drawings														
			Reinforcement	3.1	G AE												
			SD-03 Product Data														
			Welding	1.3													
			SD-07 Certificates														
			Reinforcing Steel	2.3													
		03307A	SD-03 Product Data														

SUBMITTAL REGISTER

CONTRACT NO.
NY COE

TITLE AND LOCATION FY05 Replace Dormitory, Thule AB, Greenland						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC NO	DESCRIPTION	PARAGRAPH	CLASIFICATION S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	ACTION (j)	DATE OF ACTION (k)		DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)			ACTION (o)
		03307A	Air-Entraining Admixture	2.1.3.1	G AE												
			Accelerating Admixture	2.1.3.2	G AE												
			Water-Reducing or Retarding Admixture	2.1.3.3	G AE												
			Curing Materials	2.1.9	G AE												
			Reinforcing Steel	2.1.5	G AE												
			Batching and Mixing Equipment	3.1.4.3	G												
			Conveying and Placing Concrete Formwork	3.2	G												
			SD-06 Test Reports	2.1.6	G												
			Aggregates	2.1.2	G AE												
			Concrete Mixture Proportions	1.4.3	G AE												
			SD-07 Certificates														
			Cementitious Materials	2.1.1	G AE												
			Aggregates	2.1.2	G AE												
		03410A	SD-02 Shop Drawings														
			Precast/Prestressed Units	1.3	G AE												
			SD-03 Product Data														
			Precast/Prestressed Units	1.3													
			SD-06 Test Reports														
			Tests	2.2													
		03415A	SD-02 Shop Drawings														
			Erection	3.9	G AE												
			SD-03 Product Data														
			Erection Plan	3.9.4	G AE												
			Design Calculations	1.3.1.3	G AE												

SUBMITTAL REGISTER

CONTRACT NO.
NY COE

TITLE AND LOCATION FY05 Replace Dormitory, Thule AB, Greenland						CONTRACTOR											
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N / R E V I E W I N G	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	APPROVING AUTHORITY		DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED BY (i)	A C T I O N C O D E	DATE OF ACTION (k)		DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)				A C T I O N C O D E
		03415A	Concrete Mixture Proportions	2.2	G AE												
			Construction Records	3.10	G												
			SD-06 Test Reports														
			Materials	2.1	G												
			Concrete	1.3.2.1	G												
			SD-07 Certificates														
			Cement	2.1.1	G AE												
			Pozzolan	2.1.2	G AE												
			Air-Entraining Admixture	2.1.3.2	G AE												
			Water-Reducing Admixture	2.1.3.2	G AE												
			Accelerating Admixture	2.1.3.2	G AE												
			Aggregates	2.1.3.1	G AE												
			Air Content	1.3.2.2	G AE												
		05090A	SD-03 Product Data														
			Welding Procedure Qualifications	1.5	G												
			Welder, Welding Operator, and	1.6													
			Tacker Qualification														
			Inspector Qualification	1.7													
			Previous Qualifications	1.5.1													
			Prequalified Procedures	1.5.2													
			SD-06 Test Reports														
			Quality Control	3.2													
		05120	SD-02 Shop Drawings														
			Erection Plan	1.6.2.1	G AE												
			Fabrication drawings	1.6.1	G AE												
			SD-03 Product Data														

SUBMITTAL REGISTER

CONTRACT NO.
NY COE

TITLE AND LOCATION						CONTRACTOR											
FY05 Replace Dormitory, Thule AB, Greenland																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	BY (i)	A C T I O N C O D E	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E			DATE OF ACTION (p)
		05120	Shop primer	2.4													
			Load indicator bolts	2.2.4	G AE												
			SD-06 Test Reports														
			Class B coating	2.4													
			Bolts, nuts, and washers	2.2													
			SD-07 Certificates														
			Steel	2.1													
			Bolts, nuts, and washers	2.2													
			Shop primer	2.4													
			Welding electrodes and rods	2.3.1													
			Nonshrink grout	2.3.2													
			Galvanizing	2.5													
			Welding procedures and qualifications	1.6.2.2													
		05210A	SD-02 Shop Drawings														
			Steel Joists	1.3	G AE												
			SD-07 Certificates														
			Steel Joists	1.3	G AE												
		05310	SD-02 Shop Drawings														
			Fabrication Drawings	1.3.5													
			SD-03 Product Data														
			Deck Units	2.3.1													
			Accessories	2.2													
			Mechanical Fasteners	2.2.11													
			SD-05 Design Data														
			Deck Units	2.3.1													

SUBMITTAL REGISTER

CONTRACT NO.
NY COE

TITLE AND LOCATION						CONTRACTOR											
FY05 Replace Dormitory, Thule AB, Greenland																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N	DATE RCD FROM CONTR	DATE FWD TO APPR AUTH/ TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF A C T I O N
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		05310	SD-07 Certificates														
			Deck Units	2.3.1													
			Accessories	2.2													
			Qualification of Welders	1.3.3													
			Fire Safety	1.3.4.1													
			Wind Storm Resistance	1.3.4.2													
		05400	SD-02 Shop Drawings														
			Framing Components	1.6.1	G AE												
			SD-03 Product Data														
			studs,joists	2.1													
			SD-05 Design Data														
			Metal framing calculations		G AE												
			pre-engineered roof truss system														
			SD-07 Certificates														
			Load-bearing cold-formed metal	1.4													
			framing														
			Welds	3.1.1													
		05500A	SD-02 Shop Drawings														
			Miscellaneous Metal Items	1.6													
		06100N	SD-06 Test Reports														
			Preservative-treated														
			SD-07 Certificates														
			Certificates of grade	1.7.3													
		06200A	SD-02 Shop Drawings														
			Finish Carpentry														
			SD-03 Product Data														

SUBMITTAL REGISTER

CONTRACT NO.
NY COE

TITLE AND LOCATION FY05 Replace Dormitory, Thule AB, Greenland						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC NO	DESCRIPTION	PARAGRAPH	GLASS / FIVE CARVIEW CLAS OR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT (g)	BY (h)	BY (i)	ACTION (j)	DATE OF ACTION (k)		DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)			ACTION (o)
		06200A	Wood Items, Siding, and Trim	2.1													
			SD-04 Samples														
			Moldings														
		06650	SD-02 Shop Drawings														
			Shop Drawings	1.7	G												
			Installation	3.2	G												
			SD-03 Product Data														
			Solid polymer material	2.1													
			Qualifications	1.6													
			Fabrications	2.3													
			SD-04 Samples														
			Material	2.1	G												
			Counter and Vanity Tops	2.3.6	G												
			SD-06 Test Reports														
			Solid polymer material	2.1													
			SD-07 Certificates														
			Fabrications	2.3													
			Qualifications	1.6													
			SD-10 Operation and Maintenance														
			Data														
			Clean-up	3.3													
		07212N	SD-03 Product Data														
			Blanket insulation	2.1													
			Sill sealer insulation	2.2													
			Vapor retarder	2.4													
			Pressure sensitive tape	2.5													

SUBMITTAL REGISTER

CONTRACT NO.
NY COE

TITLE AND LOCATION						CONTRACTOR										
FY05 Replace Dormitory, Thule AB, Greenland																
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS
						DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	DATE OF ACTION	DATE OF ACTION					
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	DATE OF ACTION	DATE OF ACTION	DATE OF ACTION	DATE OF ACTION	DATE OF ACTION	DATE OF ACTION	(r)
		07212N	Accessories	2.6												
			SD-08 Manufacturer's Instructions													
			Insulation	3.2.1												
		07410N	SD-02 Shop Drawings													
			Panels	2.1	G											
			Fasteners	2.1.4	G											
			Supports	2.1.4	G											
			Flashing	3.1.1	G											
			Closures	3.1.1	G											
			SD-03 Product Data													
			Panels	2.1	G											
			Accessories	2.1.3												
			Fasteners	2.1.4												
			warranty	1.7	G											
			SD-04 Samples													
			Panels	2.1	G											
			SD-06 Test Reports													
			Formability test	1.3.3												
			Weathering test	1.3.4												
			Chalking resistance	1.3.5												
			Color change	1.3.6												
			Specular gloss	1.3.7												
			Salt spray test	1.3.8												
			Abrasion resistance test	1.3.9												
			Humidity test	1.3.10												
			Wind uplift	1.3.2												

SUBMITTAL REGISTER

CONTRACT NO.
NY COE

TITLE AND LOCATION						CONTRACTOR											
FY05 Replace Dormitory, Thule AB, Greenland																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G # R A P H	C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	APPROVING AUTHORITY			MAILED TO CONTR/ DATE RCD FRM APPR		
							APPROVAL NEEDED	MATERIAL NEEDED	A C T I O N C O D E	DATE OF ACTION		DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF ACTION
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	SUBMIT (g)	BY (h)	BY (i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	REMARKS (r)
		07410N	SD-07 Certificates														
			Qualification of installer	1.5.3													
			SD-11 Closeout Submittals														
			Information card														
		07840	SD-02 Shop Drawings														
			Firestopping Materials	2.1													
			SD-07 Certificates														
			Firestopping Materials	2.1													
			Installer Qualifications	1.5													
			Inspection	3.3													
		07920	SD-03 Product Data														
			Sealants	2.1													
			Primers	2.2													
			Bond breakers	2.3													
			Backstops	2.4													
			SD-07 Certificates														
			Sealant	3.3.6													
		08110	SD-02 Shop Drawings														
			Doors	2.1	G G												
			Doors	2.1	G G												
			Frames	2.6	G G												
			Frames	2.6	G G												
			Accessories	2.4													
			Weatherstripping	2.8													
			SD-03 Product Data														
			Doors	2.1	G												

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A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT (g)	BY (h)	BY (i)	A C T I O N C O D E	DATE OF A C T I O N (k)		DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)			A C T I O N C O D E
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		08110	Frames	2.6	G												
			Accessories	2.4													
			Weatherstripping	2.8													
			SD-04 Samples														
			Factory-applied enamel finish	2.10.3	G												
		08210	SD-02 Shop Drawings														
			Doors	2.1	G												
			SD-03 Product Data														
			Doors	2.1	G												
			Accessories	2.2													
			Water-resistant sealer	2.3.7													
			warranty	1.4													
			Sound transmission class rating	2.1.2	G												
			Fire resistance rating		G												
			SD-04 Samples														
			Doors	2.1													
			Door finish colors	2.3.6.4	G												
			SD-06 Test Reports														
			Split resistance	2.4													
			Cycle-slam	2.4													
			Hinge loading resistance	2.4													
		08560	SD-02 Shop Drawings														
			Windows	2.2.1	G G												
			Windows	2.2.1	G G												
			SD-03 Product Data														
			Windows	2.2.1	G												

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TITLE AND LOCATION FY05 Replace Dormitory, Thule AB, Greenland						CONTRACTOR												
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION	PARAGRAPH	CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			DATE OF ACTION	DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	ACTION CODE (j)	DATE OF ACTION (k)		DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)				DATE OF ACTION (p)
		08560	Hardware	2.4.4														
			Fasteners	2.4.7														
			Screens															
			Weatherstripping	2.4.5														
			Accessories	2.4.8														
			SD-04 Samples															
			Windows	2.2.1	G													
			SD-06 Test Reports															
			Windows	2.2.1	G													
			SD-10 Operation and Maintenance															
			Data															
			Windows	2.2.1	G													
		08710	SD-02 Shop Drawings															
			Hardware schedule	1.3	G													
			Keying system	2.3.4														
			SD-03 Product Data															
			Hardware items	2.3	G													
			SD-08 Manufacturer's Instructions															
			Installation	3.1														
			SD-10 Operation and Maintenance															
			Data															
			Hardware Schedule	1.3	G													
			SD-11 Closeout Submittals															
			Key biting	1.4														
		08800	SD-08 Manufacturer's Instructions															
			Setting and sealing materials	2.3														

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A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/		
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			A C T I O N C O D E
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	REMARKS (r)
		08800	Glass setting	3.2													
		09100	SD-02 Shop Drawings														
			Metal support systems	2.1	G												
		09250	SD-03 Product Data														
			Cementitious backer units														
			Glass Mat Water-Resistant														
			Gypsum Tile Backing Board														
			Water-Resistant Gypsum Backing Board														
			Glass Mat Covered or Reinforced														
			Gypsum Sheathing														
			Glass Mat Covered or Reinforced														
			Gypsum Sheathing Sealant														
			Impact Resistant Gypsum Board														
			Accessories	2.1.7													
			SD-07 Certificates														
			Asbestos Free Materials	2.1	G												
		09310	SD-03 Product Data														
			Tile	2.1													
			Setting-Bed	2.2													
			Mortar, Grout, and Adhesive	2.4													
			SD-04 Samples														
			Tile	2.1													
			Accessories														
			Marble Thresholds														
			SD-06 Test Reports														

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ACTIVITY NO	TRANSMITTAL NO	SPEC NO	DESCRIPTION	PARAGRAPH	CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT	BY	BY	ACTION	DATE OF ACTION		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		09310	Testing														
			SD-07 Certificates														
			Tile	2.1													
			Mortar, Grout, and Adhesive	2.4													
		09510	SD-02 Shop Drawings														
			Approved Detail Drawings	1.3													
			SD-03 Product Data														
			Acoustical Ceiling Systems														
			SD-04 Samples														
			Acoustical Units	2.1													
			SD-07 Certificates														
			Acoustical Units	2.1													
		09650	SD-02 Shop Drawings														
			Resilient Flooring and Accessories	2.9	G												
			SD-03 Product Data														
			Resilient Flooring and Accessories	2.9	G												
			Adhesives	2.5													
			SD-04 Samples														
			Resilient Flooring and Accessories	2.9	G												
			SD-06 Test Reports														
			Moisture, Alkalinity and Bond Tests	3.3	G												
			SD-08 Manufacturer's Instructions														

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TITLE AND LOCATION FY05 Replace Dormitory, Thule AB, Greenland						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC NO	DESCRIPTION	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT	BY	BY	ACTION	DATE OF ACTION		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		09650	Surface Preparation	3.2													
			Installation	3.1													
			SD-10 Operation and Maintenance														
			Data														
			Resilient Flooring and	2.9	G												
			Accessories														
		09680	SD-02 Shop Drawings														
			Installation	3.4													
			Molding	2.4													
			SD-03 Product Data														
			Carpet	2.1													
			Surface Preparation	3.1													
			Installation	3.4													
			Regulatory Requirements	1.3													
			SD-04 Samples														
			Carpet	2.1													
			Molding	2.4													
			SD-06 Test Reports														
			Moisture and Alkalinity Tests	3.2													
			SD-07 Certificates														
			Carpet	2.1													
			Regulatory Requirements	1.3													
			SD-10 Operation and Maintenance														
			Data														
			Carpet	2.1													
			Cleaning and Protection	3.5													

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FY05 Replace Dormitory, Thule AB, Greenland																	
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION	PARAGRAPH	CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/	REMARKS	
						SUBMIT	BY	MATERIAL NEEDED	ACTION	DATE OF ACTION	DATE RCD FROM CONTR	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		09720	SD-03 Product Data														
			Wallcoverings and Accessories	2.1	G												
			Primer and Adhesive	2.3													
			SD-04 Samples														
			Wallcoverings and Accessories	2.1	G												
			SD-07 Certificates														
			Wallcoverings and Accessories	2.1													
			SD-08 Manufacturer's Instructions														
			Wallcoverings and Accessories	2.1													
			SD-10 Operation and Maintenance Data														
			Wallcoverings	2.1													
		09900	SD-02 Shop Drawings														
			Piping identification stencil														
			SD-03 Product Data														
			Coating	2.1	G												
			Manufacturer's Technical Data	2.1													
			Sheets														
			Sealant														
			SD-04 Samples														
			Color	1.9	G												
			Textured Wall Coating System	1.4.2	G												
			Sample Textured Wall Coating	1.4.3	G												
			System Mock-Up														
			SD-07 Certificates														

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A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
	09900		Applicator's qualifications	1.3													
			Qualification Testing	1.4.1.2	G												
			SD-08 Manufacturer's Instructions														
			Application instructions														
			Mixing	3.5.2													
			Manufacturer's Material Safety	1.7.2													
			Data Sheets														
			SD-10 Operation and Maintenance														
			Data														
			Coatings:	2.1	G												
	09915		SD-04 Samples														
			Color Schedule	2.2													
	10260		SD-02 Shop Drawings														
			Corner Guards	2.2													
			Wall Guards (Bumper Guards)														
			Door Protectors														
			Wall Covering/Panels														
			SD-03 Product Data														
			Corner Guards	2.2													
			SD-04 Samples														
			Finish	2.4													
			SD-06 Test Reports														
			Corner Guards	2.2													
			SD-07 Certificates														
			Corner Guards	2.2													
	10440		SD-02 Shop Drawings														

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A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)		DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)			A C T I O N C O D E (o)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		10440	Detail Drawings	3.1													
			SD-03 Product Data														
			Installation	3.1													
			SD-04 Samples														
			Interior Signage	1.3													
			SD-10 Operation and Maintenance														
			Data														
			Approved Manufacturer's	3.1													
			Instructions														
			Protection and Cleaning	3.1.2													
		10500	SD-02 Shop Drawings														
			Types	2.1	G												
			Location	2.1	G												
			Installation	3.1													
			Numbering system	3.2													
			SD-03 Product Data														
			Material	2.2													
			Finish	2.2.2													
			components	2.3													
			Assembly	3.1													
			SD-04 Samples														
			Color chips	1.4.1	G												
		10800	SD-03 Product Data														
			Finishes	2.1.2													
			Accessory Items	2.2													
			SD-04 Samples														

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ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	ACTION CODE (j)	DATE OF ACTION (k)		DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTHER REVIEWER (n)			ACTION CODE (o)
	10800		Finishes	2.1.2													
			Accessory Items	2.2													
			SD-07 Certificates														
			Accessory Items	2.2													
			SD-10 Operation and Maintenance Data														
			Electric Hand Dryer														
	12490A		SD-02 Shop Drawings														
			Approved Detail Drawings	3.2	G												
			SD-03 Product Data														
			Window Treatments	3.2													
			Hardware	1.2													
			SD-04 Samples														
			Window Treatments	3.2													
	13280A		SD-03 Product Data														
			Respiratory Protection Program	1.12	G												
			Cleanup and Disposal	3.11	G												
			Detailed Drawings	3.6.5.1	G												
			Qualifications	1.5	G												
			Training Program	1.11													
			Medical Requirements	1.10													
			Encapsulants	2.1													
			SD-06 Test Reports														
			Exposure Assessment and Air Monitoring	3.9	G												
			Local Exhaust Ventilation	1.20													

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A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)		DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)			A C T I O N C O D E (o)
		13280A	Licenses, Permits and Notifications	1.14	G												
		13282N	SD-01 Preconstruction Submittals														
			Lead Compliance Plan	1.5.2.2	G												
			Competent Person	1.5.1.1	G												
			Training Certification	1.5.1.2	G												
			lead waste management plan	1.5.2.8	G												
			written evidence	3.5.2.1	G												
			Medical Examinations	1.5.2.4	G												
			SD-06 Test Reports														
			sampling results	1.5.2.3													
			Occupational and Environmental Assessment Data Report	1.5.2.3	G												
			SD-07 Certificates														
			Testing laboratory	1.5.1.3	G												
			Clearance Certification	3.5.1.1	G												
			SD-11 Closeout Submittals														
			hazardous waste manifest	3.5.2.1	G												
			turn-in documents or weight tickets	3.5.2.1	G												
		13851A	SD-02 Shop Drawings														
			Fire Alarm Reporting System	1.4.1	G AE												
			SD-03 Product Data														
			Storage Batteries	2.2	G												
			Voltage Drop		G												
			Special Tools and Spare Parts	2.7.3													

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TITLE AND LOCATION						CONTRACTOR											
FY05 Replace Dormitory, Thule AB, Greenland																	
ACTIVITY NO	TRANSMITTAL NO	SPEC	DESCRIPTION	PARAGRAPH	CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/	REMARKS	
						SUBMIT	BY	BY	ACTION	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM CONTR	DATE RCD FROM OTH REVIEWER			ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		13851A	FIO.														
			Technical Data and Computer Software	1.5	G												
			Training	3.5													
			Testing	3.4	G												
			SD-06 Test Reports														
			Testing	3.4	G												
			SD-07 Certificates														
			Equipment		G												
			Qualifications	1.3.7													
			FIO.														
			SD-10 Operation and Maintenance														
			Data														
			Technical Data and Computer Software	1.5	G												
		13920A	SD-02 Shop Drawings														
			Installation Requirements	3.3	G												
			As-Built Drawings	3.8.7													
			SD-03 Product Data														
			Fire Pump Installation Related	3.1													
			Submittals														
			Installation Requirements	3.3	G												
			Spare Parts	1.3													
			Preliminary Test	3.8.2													
			Field Tests	3.8	G												
			Fire Protection Specialist	1.8	G												

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A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)		DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)			A C T I O N C O D E (o)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		13920A	Manufacturer's Representative	1.9	G												
			Field Training	3.10	G												
			Final Acceptance Test	3.8.3													
			SD-06 Test Reports														
			Preliminary Test	3.8.2	G												
			Final Acceptance Test	3.8.3	G												
			SD-07 Certificates														
			Fire Protection Specialist	1.8	G												
			SD-10 Operation and Maintenance														
			Data														
			Fire Pumps	3.8.2													
		13930A	SD-02 Shop Drawings														
			Shop Drawings	1.12	G												
			As-Built Drawings	3.10													
			SD-03 Product Data														
			Fire Protection Related	3.1													
			Submittals														
			Materials and Equipment	2.3	G												
			Hydraulic Calculations	1.7	G												
			Spare Parts	1.11													
			Preliminary Tests	3.9	G												
			Final Acceptance Test	3.10	G												
			On-site Training	3.11	G												
			Fire Protection Specialist	1.8	G												
			Sprinkler System Installer	1.9	G												
			SD-06 Test Reports														

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TITLE AND LOCATION						CONTRACTOR											
FY05 Replace Dormitory, Thule AB, Greenland																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N / R E V I E W I N G	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
		13930A	Preliminary Test Report	3.10	G												
			Final Acceptance Test Report	3.10	G												
			SD-07 Certificates														
			Inspection by Fire Protection Specialist	3.3	G												
			SD-10 Operation and Maintenance Data														
			Operating and Maintenance Instructions	3.11													
		13975N	SD-02 Shop Drawings														
			Standpipe system	1.4.4	G												
			SD-03 Product Data														
			Pipe and fittings	2.1.1	G												
			Mechanical couplings	2.1.1	G												
			Pipe hangers and supports	2.1.2	G												
			Valves	2.1.3	G												
			Fire department connections	2.1.7	G												
			Waterflow detector	2.1.8	G												
			Fire hose cabinets	2.1.9	G												
			Valve tamper switch	2.1.10	G												
			SD-06 Test Reports														
			Preliminary tests	3.7.1	G												
			Acceptance tests	3.7.2	G												
			SD-07 Certificates														
			Qualifications of installer	1.6.1	G												
			SD-11 Closeout Submittals														

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TITLE AND LOCATION						CONTRACTOR											
FY05 Replace Dormitory, Thule AB, Greenland																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G # R A P H	G O V T C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	
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(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	SUBMIT (g)	BY (h)	BY (i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	REMARKS (r)
		13975N	System as-built drawings	1.6.2	G												
		15080A	SD-02 Shop Drawings														
			Mica Plates	3.2.2.4													
			SD-03 Product Data														
			General Materials	2.1													
			SD-04 Samples														
			Thermal Insulation Materials														
		15400A	SD-02 Shop Drawings														
			Plumbing System	3.7.1	G												
			SD-03 Product Data														
			Plumbing Fixture Schedule	3.8													
			Plumbing System	3.7.1													
			SD-06 Test Reports														
			Tests, Flushing and Disinfection	3.7													
			Test of Backflow Prevention	3.7.1.1	G												
			Assemblies														
			SD-07 Certificates														
			Materials and Equipment	1.3													
			Bolts	2.1.1													
			SD-10 Operation and Maintenance														
			Data														
			Plumbing System	3.7.1	G												
		15556A	SD-02 Shop Drawings														
			Heating Systems	2.15													
			SD-03 Product Data														
			Welding	3.3													

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ACTIVITY NO	TRANSMITTAL NO	SPEC	DESCRIPTION	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT	APPROVAL NEEDED	MATERIAL NEEDED	ACTION CODE	DATE OF ACTION		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION CODE
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		15556A	Framed Instructions	3.19													
			SD-06 Test Reports														
			Testing and Cleaning	3.16													
			Water Treatment Testing	3.16.4													
			SD-07 Certificates														
			Bolts	2.2.7													
			SD-10 Operation and Maintenance														
			Data														
			Heating Systems	2.15													
		15895	SD-02 Shop Drawings														
			Drawings	2.7.1	G												
			Installation	3.1	G												
			SD-03 Product Data														
			Components and Equipment	2.1													
			Diagrams	3.1	G												
			Manufacturer's Experience	2.1													
			Performance Tests	3.6	G												
			Field Training	3.8	G												
			SD-06 Test Reports														
			Performance Tests	3.6													
			Testing, Adjusting, and Balancing	3.5													
			SD-10 Operation and Maintenance														
			Data														
			Operating and Maintenance	3.8													
			Instructions														
		15951A	SD-02 Shop Drawings														

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ACTIVITY NO	TRANSMITTAL NO	SPEC	DESCRIPTION	PARAGRAPH	CLASSTITLE	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/	REMARKS	
						SUBMIT	BY	BY	ACTION	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE FWD TO OTHER REVIEWER	DATE OF ACTION			DATE RCD FRM APPR
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	15951A		HVAC Control System	3.1.1	G												
			SD-03 Product Data														
			Service Organizations	1.7.2													
			Equipment Compliance Booklet	1.6													
			Commissioning Procedures	3.4													
			Performance Verification Test	1.6													
			Procedures														
			Training	3.6	G												
			SD-06 Test Reports														
			Commissioning Report	3.6.2													
			Performance Verification Test	3.5.3	G												
			SD-10 Operation and Maintenance														
			Data														
			Operation Manual	1.5													
			Maintenance and Repair Manual	1.6													
	15990A		SD-02 Shop Drawings														
			TAB Schematic Drawings and	3.3	G												
			Report Forms														
			SD-03 Product Data														
			TAB Related HVAC Submittals	3.2													
			TAB Procedures	3.5.1	G												
			Calibration	1.4													
			Systems Readiness Check	3.5.2													
			TAB Execution	3.5.1	G												
			TAB Verification	3.5.4	G												
			SD-06 Test Reports														

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FY05 Replace Dormitory, Thule AB, Greenland																	
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									A C T I O N C O D E	DATE OF ACTION		DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E	DATE OF ACTION		
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	SUBMIT (g)	BY (h)	BY (i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	REMARKS (r)
		15990A	Design Review Report	3.1	G												
			Systems Readiness Check	3.5.2	G												
			TAB Report	3.5.3	G												
			TAB Verification Report	3.5.4	G												
			SD-07 Certificates														
			Ductwork Leak Testing	3.4													
			TAB Firm	1.5.1	G												
			TAB Specialist	1.5.2	G												
		15995A	SD-03 Product Data														
			Commissioning Team	3.1													
			Tests	3.2													
			Pre-Commissioning Checks	3.2.1	G												
			SD-06 Test Reports														
			Test Reports	3.2	G												
		16415A	SD-02 Shop Drawings														
			Interior Electrical Equipment		G												
			SD-03 Product Data														
			Fault Current and Protective														
			Device Coordination Study														
			Manufacturer's Catalog														
			Material, Equipment, and Fixture														
			Lists														
			As-Built Drawings	1.2.6	G												
			Onsite Tests	3.20.2	G												
			SD-06 Test Reports														
			Factory Test Reports		G												

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ACTIVITY NO	TRANSMITTAL NO	SPEC	DESCRIPTION	PARAGRAPH	CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			DATE OF ACTION	DATE RCD FRM APPR	REMARKS
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	ACTION CODE (j)	DATE OF ACTION (k)		DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTHER REVIEWER (n)			
	16415A		Field Test Reports	3.18	G												
			SD-07 Certificates														
			Materials and Equipment	1.4													
	16710A		SD-02 Shop Drawings														
			Premises Distribution System	1.7	G												
			Installation	3.1	G												
			SD-03 Product Data														
			Record Keeping and Documentation	1.8	G												
			Spare Parts	3.1.7													
			Manufacturer's Recommendations	3.1.2	G												
			Test Plan	3.6	G												
			Qualifications	1.5	G												
			SD-06 Test Reports														
			Test Reports	3.6	G												
			SD-07 Certificates														
			Premises Distribution System	1.7													
			Materials and Equipment	2.1													
			Installers	1.5.1	G												
	16711A		SD-02 Shop Drawings														
			Installation	3.1													
			Record Drawings		G												
			SD-03 Product Data														
			Equipment	1.5.2													
			Installation	3.1	G												

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TITLE AND LOCATION						CONTRACTOR											
FY05 Replace Dormitory, Thule AB, Greenland																	
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION	PARAGRAPH	G O V T CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/	REMARKS	
						SUBMIT	BY	BY	ACTION	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	DATE OF ACTION			DATE RCD FRM APPR AUTH
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		16711A	Acceptance Tests	3.5	G												
			Cutover and Records	3.4	G												
			SD-06 Test Reports														
			Acceptance Tests	3.5													
			SD-07 Certificates														
			Telephone System														
			Qualifications	1.4	G												
		16713N	SD-02 Shop Drawings														
			Fiber Optic System	1.4.1	G												
			SD-03 Product Data														
			Fiber Optic Media Types	2.1.1	G												
			Fiber Optic Splices	2.2	G												
			Fiber Optic Terminations and Connectors	2.4	G												
			Fiber Optic Enclosures	2.3	G												
			SD-06 Test Reports														
			Fiber Optic Factory Test Plan	1.4.5	G												
			Fiber Optic Field Tests Plan	1.4.6	G												
			SD-07 Certificates														
			Fiber Optic Cable Installer and Splicer Qualifications	1.4.2	G												
			Manufacturer's qualifications	1.4.4	G												
			SD-08 Manufacturer's Instructions														
			Fiber optic system instructions	1.4.3	G												
		16770	SD-02 Shop Drawings														
			Detail Drawings	1.3.3	G												

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ACTIVITY NO	TRANSMITTAL NO	SPEC NO	DESCRIPTION	PARAGRAPH	CLASSIFICATION G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ AUTH	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	ACTION CODE (j)	DATE OF ACTION (k)	DATE FWD TO APPR AUTH/ FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)	ACTION CODE (o)			DATE OF ACTION (p)
		16770	SD-03 Product Data														
			Spare Parts	1.3.4													
			SD-06 Test Reports														
			Approved Test Procedures	3.3	G												
			Acceptance Tests	3.3													
			SD-07 Certificates														
			Components	2.1													
			SD-10 Operation and Maintenance														
			Data														
			Radio and Public Address	1.3													
			System														
		16815A	SD-02 Shop Drawings														
			Cable Television Premises	2.1	G												
			Distribution System														
			Installation	3.1	G												
			SD-03 Product Data														
			Spare Parts	3.4													
			Manufacturer's	1.5.1	G												
			Recommendations														
			Test Plan	3.6	G												
			Qualifications	1.5	G												
			SD-06 Test Reports														
			Testing	3.6													
			SD-07 Certificates														
			Materials and Equipment	2.1													

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SCHEDULE DATES

CONTRACTOR ACTION	
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APPROVING AUTHORITY

[illegible]

SECTION 01355A

ENVIRONMENTAL PROTECTION
02/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. ARMY (DA)

AR 200-5 (1999) Pest Management

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (1996) Safety and Health Requirements
Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 152 - 186	Pesticide Programs
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 279	Standards for the Management of Used Oil
49 CFR 171 - 178	Hazardous Materials Regulations

1.2 DEFINITIONS

1.2.1 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally and/or historically.

1.2.2 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat

disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2.3 Contractor Generated Hazardous Waste

Contractor generated hazardous waste means materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene etc.), waste thinners, excess paints, excess solvents, waste solvents, and excess pesticides, and contaminated pesticide equipment rinse water.

1.2.4 Installation Pest Management Coordinator

Installation Pest Management Coordinator (IPMC) is the individual officially designated by the Installation Commander to oversee the Installation Pest Management Program and the Installation Pest Management Plan.

1.2.5 Land Application for Discharge Water

The term "Land Application" for discharge water implies that the Contractor shall discharge water at a rate which allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" shall occur. Land Application shall be in compliance with all applicable Federal, State, and local laws and regulations.

1.2.6 Pesticide

Pesticide is defined as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, or intended for use as a plant regulator, defoliant or desiccant.

1.2.7 Pests

The term "pests" means arthropods, birds, rodents, nematodes, fungi, bacteria, viruses, algae, snails, marine borers, snakes, weeds and other organisms (except for human or animal disease-causing organisms) that adversely affect readiness, military operations, or the well-being of personnel and animals; attack or damage real property, supplies, equipment, or vegetation; or are otherwise undesirable.

1.2.8 Surface Discharge

The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm

sewers, creeks, and/or "waters of the United States" and would require a permit to discharge water from the governing agency.

1.3 GENERAL REQUIREMENTS

The Contractor shall minimize environmental pollution and damage that may occur as the result of construction operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract. The Contractor shall comply with all applicable environmental Federal, State, and local laws and regulations. The Contractor shall be responsible for any delays resulting from failure to comply with environmental laws and regulations.

1.4 SUBCONTRACTORS

The Contractor shall ensure compliance with this section by subcontractors.

1.5 PAYMENT

No separate payment will be made for work covered under this section. The Contractor shall be responsible for payment of fees associated with environmental permits, application, and/or notices obtained by the Contractor. All costs associated with this section shall be included in the contract price. The Contractor shall be responsible for payment of all fines/fees for violation or non-compliance with Federal, State, Regional and local laws and regulations.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Environmental Protection Plan; G

The environmental protection plan.

1.7 ENVIRONMENTAL PROTECTION PLAN

Prior to commencing construction activities or delivery of materials to the site, the Contractor shall submit an Environmental Protection Plan for review and approval by the Contracting Officer. The purpose of the Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues which the Contractor must address during construction. Issues of concern shall be defined within the Environmental Protection Plan as outlined in this section. The Contractor shall address each topic at a level of detail commensurate with the environmental issue and required construction task(s). Topics or issues which are not identified in this section, but which the Contractor

considers necessary, shall be identified and discussed after those items formally identified in this section. Prior to submittal of the Environmental Protection Plan, the Contractor shall meet with the Contracting Officer for the purpose of discussing the implementation of the initial Environmental Protection Plan; possible subsequent additions and revisions to the plan including any reporting requirements; and methods for administration of the Contractor's Environmental Plans. The Environmental Protection Plan shall be current and maintained onsite by the Contractor.

1.7.1 Compliance

No requirement in this Section shall be construed as relieving the Contractor of any applicable Federal and local environmental protection laws and regulations. During Construction, the Contractor shall be responsible for identifying, implementing, and submitting for approval any additional requirements to be included in the Environmental Protection Plan.

1.7.2 Contents

The environmental protection plan shall include, but shall not be limited to, the following:

- a. Name(s) of person(s) within the Contractor's organization who is(are) responsible for ensuring adherence to the Environmental Protection Plan.
- b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site, if applicable.
- c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
- d. Description of the Contractor's environmental protection personnel training program.
- e. An erosion and sediment control plan which identifies the type and location of the erosion and sediment controls to be provided. The plan shall include monitoring and reporting requirements to assure that the control measures are in compliance with the erosion and sediment control plan, Federal and local laws and regulations. A Storm Water Pollution Prevention Plan (SWPPP) may be substituted for this plan.
- f. Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on the site.
- g. Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plan shall include measures to minimize the amount of mud transported onto paved public roads by vehicles or runoff.
- h. Work area plan showing the proposed activity in each portion of the

area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas including methods for protection of features to be preserved within authorized work areas.

i. Drawing showing the location of borrow areas.

j. A non-hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris. The plan shall include schedules for disposal. The Contractor shall identify any subcontractors responsible for the transportation and disposal of solid waste. Licenses or permits shall be submitted for solid waste disposal sites that are not a commercial operating facility. Evidence of the disposal facility's acceptance of the solid waste shall be attached to this plan during the construction. The Contractor shall attach a copy of each of the Non-hazardous Solid Waste Diversion Reports to the disposal plan. The report shall be submitted on the first working day after the first quarter that non-hazardous solid waste has been disposed and/or diverted and shall be for the previous quarter (e.g. the first working day of January, April, July, and October). The report shall indicate the total amount of waste generated and total amount of waste diverted in cubic meters or tons along with the percent that was diverted.

k. A recycling and solid waste minimization plan with a list of measures to reduce consumption of energy and natural resources. The plan shall detail the Contractor's actions to comply with and to participate in Federal, State, Regional, and local government sponsored recycling programs to reduce the volume of solid waste at the source.

l. An air pollution control plan detailing provisions to assure that dust, debris, materials, trash, etc., do not become air borne and travel off the project site.

m. A contaminant prevention plan that: identifies potentially hazardous substances to be used on the job site; identifies the intended actions to prevent introduction of such materials into the air, water, or ground; and details provisions for compliance with Federal, State, and local laws and regulations for storage and handling of these materials. In accordance with EM 385-1-1, a copy of the Material Safety Data Sheets (MSDS) and the maximum quantity of each hazardous material to be on site at any given time shall be included in the contaminant prevention plan. As new hazardous materials are brought on site or removed from the site, the plan shall be updated.

n. A waste water management plan that identifies the methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines. If a settling/retention pond is required, the plan shall include the design of the pond including drawings, removal plan, and testing requirements for possible pollutants. If land application will be the method of disposal for the waste water, the plan shall include a sketch showing the location for land application along with a description of the

pretreatment methods to be implemented. If surface discharge will be the method of disposal, a copy of the permit and associated documents shall be included as an attachment prior to discharging the waste water. If disposal is to a sanitary sewer, the plan shall include documentation that the Waste Water Treatment Plant Operator has approved the flow rate, volume, and type of discharge.

o. A pesticide treatment plan shall be included and updated, as information becomes available. The plan shall include: sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (i.e. pounds of active ingredient applied), equipment used for application and calibration of equipment. The Contractor is responsible for Federal and Local pest management record keeping and reporting requirements. The Contractor shall follow AR 200-5 Pest Management, Chapter 2, Section III "Pest Management Records and Reports" for data required to be reported to the Installation.

p. A spill prevention and control plan outlining provisions to assure that hazardous substance spills are prevented and adequately responded to.

1.7.3 Appendix

Copies of all environmental permits, permit application packages, approvals to construct, notifications, certifications, reports, and termination documents shall be attached, as an appendix, to the Environmental Protection Plan.

1.8 PROTECTION FEATURES

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey. Immediately following the survey, the Contractor shall prepare a brief report including a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. This survey report shall be signed by both the Contractor and the Contracting Officer upon mutual agreement as to its accuracy and completeness. The Contractor shall protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference which their preservation may cause to the Contractor's work under the contract.

1.9 ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations, requested by the Contractor, from the drawings, plans and specifications which may have an environmental impact will be subject to approval by the Contracting Officer and may require an extended review,

processing, and approval time. The Contracting Officer reserves the right to disapprove alternate methods, even if they are more cost effective, if the Contracting Officer determines that the proposed alternate method will have an adverse environmental impact.

1.10 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with Federal or local environmental laws or regulations, permits, and other elements of the Contractor's Environmental Protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or equitable adjustments allowed to the Contractor for any such suspensions. This is in addition to any other actions the Contracting Officer may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 ENVIRONMENTAL PERMITS AND COMMITMENTS

The Contractor shall be responsible for obtaining and complying with all environmental permits and commitments required by Federal, and local environmental laws and regulations.

3.2 LAND RESOURCES

The Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, the Contractor shall identify any land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. The Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, soil, or other materials displaced into uncleared areas shall be removed by the Contractor.

3.2.1 Work Area Limits

Prior to commencing construction activities, the Contractor shall mark the areas that need not be disturbed under this contract. Isolated areas within the general work area which are not to be disturbed shall be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, any markers shall be visible in the dark. The Contractor's personnel shall be knowledgeable of the purpose for marking

and/or protecting particular objects.

3.2.2 Contractor Facilities and Work Areas

The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only when approved.

3.3 WATER RESOURCES

The Contractor shall monitor construction activities to prevent pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil unless otherwise indicated. All water areas affected by construction activities shall be monitored by the Contractor. For construction activities immediately adjacent to impaired surface waters, the Contractor shall be capable of quantifying sediment or pollutant loading to that surface water when required by State or Federally issued Clean Water Act permits.

3.4 AIR RESOURCES

Equipment operation, activities, or processes performed by the Contractor shall be in accordance with all Federal air emission and performance laws and standards.

3.4.1 Particulates

Dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants; shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the Federal and local air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The Contractor must have sufficient, competent equipment available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs. The Contractor shall comply with all local visibility regulations.

3.4.2 Odors

Odors from construction activities shall be controlled at all times. The odors shall not cause a health hazard and shall be in compliance with State regulations and/or local ordinances.

3.4.3 Sound Intrusions

The Contractor shall keep construction activities under surveillance and control to minimize environment damage by noise. The Contractor shall comply with the provisions of the Thule AB rules.

3.4.4 Burning

Burning shall be prohibited on the Government premises.

3.5 CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

Disposal of wastes shall be as directed below, unless otherwise specified in other sections and/or shown on the drawings.

3.5.1 Solid Wastes

Solid wastes shall be placed in containers which are emptied on a regular schedule. Handling, storage, and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall comply with Federal and local laws and regulations pertaining to the use of landfill areas.

3.5.2 Chemicals and Chemical Wastes

Chemicals shall be dispensed ensuring no spillage to the ground or water. Periodic inspections of dispensing areas to identify leakage and initiate corrective action shall be performed and documented. This documentation will be periodically reviewed by the Government. Chemical waste shall be collected in corrosion resistant, compatible containers. Collection drums shall be monitored and removed to a staging or storage area when contents are within 150 mm of the top. Wastes shall be classified, managed, stored, and disposed of in accordance with Federal, State, and local laws and regulations.

3.5.3 Contractor Generated Hazardous Wastes/Excess Hazardous Materials

Hazardous wastes are defined in 40 CFR 261, or are as defined by applicable local regulations. Hazardous materials are defined in 49 CFR 171 - 178. The Contractor shall, at a minimum, manage and store hazardous waste in compliance with 40 CFR 262 and shall manage and store hazardous waste in accordance with the Thule AB hazardous waste management plan. The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing. The Contractor shall segregate hazardous waste from other materials and wastes, shall protect it from the weather by placing it in a safe covered location, and shall take precautionary measures such as berming or other appropriate measures against accidental spillage. The Contractor shall be responsible for storage, describing, packaging, labeling, marking, and placarding of hazardous waste and hazardous material in accordance with 49 CFR 171 - 178, State, and local laws and regulations. The Contractor shall transport Contractor generated hazardous waste off Government property within 60 days in accordance with the Environmental Protection Agency and the Department

of Transportation laws and regulations. The Contractor shall dispose of hazardous waste in compliance with Federal and local laws and regulations. Spills of hazardous or toxic materials shall be immediately reported to the Contracting Officer and the Facility Environmental Office. Cleanup and cleanup costs due to spills shall be the Contractor's responsibility. The Contractor shall coordinate the disposition of hazardous waste with the Thule AB Hazardous Waste Manager and the Contracting Officer. If the Contractor has to dispose of Hazardous Wastes/ExcessHazardous Materials he/she will prepare and sign the Wastes Analysis/Wastes Profiles and Land Ban Restrictions, and in accordance with these documents shall prepare Manifest for signature of the Government. The individual preparing the documents shall be properly trained in the US EPA(RCRA) and US DOT regulations covering Hazardous Wastes Shipments. The Manifest shall include the name and telephone number of the Emergency Response point of contact per US DOT requirements. The Point of Contact shall be fully knowledgeable regarding the manifests and Hazardous Wastes/Excess Hazardous Materials and shall personally staff this telephone number at all hours, day and night during the period of shipping.

3.5.4 Fuel and Lubricants

Storage, fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants and oil shall be managed and stored in accordance with all Federal and local laws and regulations. Used lubricants and used oil to be discarded shall be stored in marked corrosion-resistant containers and recycled or disposed in accordance with 40 CFR 279, and local laws and regulations. Storage of fuel on the project site shall be in accordance with all Federal and local laws and regulations and shall only be permitted at the discretion of Thule AB and the Contracting Officer.

3.5.5 Waste Water

Disposal of waste water shall be as specified below.

- a. Waste water from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, forms, etc. shall not be allowed to enter water ways or to be discharged prior to being treated to remove pollutants. The Contractor shall dispose of the construction related waste water off-Government property in accordance with all Federal and Local laws and regulations.
- b. For discharge of ground water, the Contractor shall obtain a Federal and Local permit specific for pumping and discharging ground water prior to surface discharging.
- c. Water generated from the flushing of lines after disinfection or disinfection in conjunction with hydrostatic testing shall be discharged into the sanitary sewer with prior approval and/or notification to the Waste Water Treatment Plant's Operator.

3.6 RECYCLING AND WASTE MINIMIZATION

The Contractor shall participate in local government sponsored recycling programs.

3.7 NON-HAZARDOUS SOLID WASTE DIVERSION REPORT

The Contractor shall maintain an inventory of non-hazardous solid waste diversion and disposal of construction and demolition debris. The Contractor shall submit a report to the Contracting Officer on the first working day after each fiscal year quarter, starting the first quarter that non-hazardous solid waste has been generated. The following shall be included in the report:

- a. Construction and Demolition (C&D) Debris Disposed as appropriate.
- b. Construction and Demolition (C&D) Debris Recycled as appropriate.
- c. Total C&D Debris Generated as appropriate.
- d. Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount) as appropriate.

3.8 INTEGRATED PEST MANAGEMENT

In order to minimize impacts to existing fauna and flora, the Contractor, through the Contracting Officer, shall coordinate with the Installation Pest Management Coordinator (IPMC) Project Pesticide Coordinator (PPC) at the earliest possible time prior to pesticide application. The Contractor shall discuss integrated pest management strategies with the IPMC and receive concurrence from the IPMC through the COR prior to the application of any pesticide associated with these specifications. Pest Management personnel shall be given the opportunity to be present at all meetings concerning treatment measures for pest or disease control and during application of the pesticide. The use and management of pesticides are regulated under 40 CFR 152 - 186.

3.8.1 Pesticide Delivery and Storage

Pesticides shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses. Pesticides shall be stored according to manufacturer's instructions and under lock and key when unattended.

3.8.2 Qualifications

For the application of pesticides, the Contractor shall use the services of a subcontractor whose principal business is pest control. The subcontractor shall be licensed and certified in the state where the work is to be performed.

3.8.3 Pesticide Handling Requirements

The Contractor shall formulate, treat with, and dispose of pesticides and associated containers in accordance with label directions and shall use the clothing and personal protective equipment specified on the labeling for use during all phases of the application. Material Safety Data Sheets (MSDS) shall be available for all pesticide products.

3.8.4 Application

Pesticides shall be applied by a Locally Certified Pesticide Applicator in accordance with EPA label restrictions and recommendation. The Certified Applicator shall wear clothing and personal protective equipment as specified on the pesticide label. Water used for formulating shall only come from locations designated by the Contracting Officer. The Contractor shall not allow the equipment to overflow. Prior to application of pesticide, all equipment shall be inspected for leaks, clogging, wear, or damage and shall be repaired prior to being used.

3.9 PREVIOUSLY USED EQUIPMENT

The Contractor shall clean all previously used construction equipment prior to bringing it onto the project site. The Contractor shall ensure that the equipment is free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds.

3.10 MAINTENANCE OF POLLUTION FACILITIES

The Contractor shall maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

3.11 MILITARY MUNITIONS

In the event the Contractor discovers or uncovers military munitions as defined in 40 CFR 260, the Contractor shall immediately stop work in that area and immediately inform the Contracting Officer.

3.12 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel shall be trained in all phases of environmental protection and pollution control. The Contractor shall conduct environmental protection/pollution control meetings for all Contractor personnel prior to commencing construction activities. Additional meetings shall be conducted for new personnel and when site conditions change. The training and meeting agenda shall include: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, wetlands, and endangered species and their habitat that are known to be in the area.

3.13 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all areas used for construction in accordance with Contract Clause: "Cleaning Up". The Contractor shall, unless otherwise instructed in writing by the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed area shall be graded, filled and the entire area seeded unless otherwise indicated.

-- End of Section --

SECTION 01415A

METRIC MEASUREMENTS

08/03

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 621	(1994; R 1999e1) Use of Metric (SI) Units in Building Design and Construction (Committee E-6 Supplement to E380)
ASTM SI 10	(2002) American National Standard for Use of the International System of Units (SI): The Modern Metric System

1.2 GENERAL

This project includes metric units of measurements. The metric units used are the International System of Units (SI) developed and maintained by the General Conference on Weights and Measures (CGPM); the name International System of Units and the international abbreviation SI were adopted by the 11th CGPM in 1960. A number of circumstances require that both metric SI units and English inch-pound (I-P) units be included in a section of the specifications. When both metric and I-P measurements are included, the section may contain measurements for products that are manufactured to I-P dimensions and then expressed in mathematically converted metric value (soft metric) or, it may contain measurements for products that are manufactured to an industry recognized rounded metric (hard metric) dimensions but are allowed to be substituted by I-P products to comply with the law. Dual measurements are also included to indicate industry and/or Government standards, test values or other controlling factors, such as the code requirements where I-P values are needed for clarity or to trace back to the referenced standards, test values or codes.

1.3 USE OF MEASUREMENTS

Measurements shall be either in SI or I-P units as indicated, except for soft metric measurements or as otherwise authorized. When only SI or I-P measurements are specified for a product, the product shall be procured in the specified units (SI or I-P) unless otherwise authorized by the Contracting Officer. The Contractor shall be responsible for all associated labor and materials when authorized to substitute one system of units for another and for the final assembly and performance of the specified work and/or products.

1.3.1 Hard Metric

A hard metric measurement is indicated by an SI value with no expressed correlation to an I-P value. Hard metric measurements are often used for field data such as distance from one point to another or distance above the floor. Products are considered to be hard metric when they are manufactured to metric dimensions or have an industry recognized metric designation.

1.3.2 Soft Metric

- a. A soft metric measurement is indicated by an SI value which is a mathematical conversion of the I-P value shown in parentheses (e.g. 38.1 mm (1-1/2 inches)). Soft metric measurements are used for measurements pertaining to products, test values, and other situations where the I-P units are the standard for manufacture, verification, or other controlling factor. The I-P value shall govern while the metric measurement is provided for information.
- b. A soft metric measurement is also indicated for products that are manufactured in industry designated metric dimensions but are required by law to allow substitute I-P products. These measurements are indicated by a manufacturing hard metric product dimension followed by the substitute I-P equivalent value in parentheses (e.g., 190 x 190 x 390 mm (7-5/8 x 7-5/8 x 15-5/8 inches)).

1.3.3 Neutral

A neutral measurement is indicated by an identifier which has no expressed relation to either an SI or an I-P value (e.g., American Wire Gage (AWG) which indicates thickness but in itself is neither SI nor I-P).

1.4 COORDINATION

Discrepancies, such as mismatches or product unavailability, arising from use of both metric and non-metric measurements and discrepancies between the measurements in the specifications and the measurements in the drawings shall be brought to the attention of the Contracting Officer for resolution.

1.5 RELATIONSHIP TO SUBMITTALS

Submittals for Government approval or for information only shall cover the SI or I-P products actually being furnished for the project. The Contractor shall submit the required drawings and calculations in the same units used in the contract documents describing the product or requirement unless otherwise instructed or approved. The Contractor shall use ASTM SI 10 and ASTM E 621 as the basis for establishing metric measurements required to be used in submittals.

-- End of Section --

SECTION 01420

SAFETY
nyd 03/04

PART 1 GENERAL

1.1 SAFETY

The contractor shall comply with all applicable Federal, State, and local safety and occupational health laws and regulations. Applicable provisions of the Corps of Engineers manual entitled Safety and Health Requirements Manual EM 385-1-1, 3 Nov 2003 (with latest changes as of bid date) will be applied to all work under this contract. The referenced manual may be purchased from the U.S. Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328, or via the internet at www.USACE.army.mil.

1.2 U.S. ARMY CORPS OF ENGINEERS SAFETY AND HEALTH REQUIREMENTS MANUAL, EM 385-1-1:

This paragraph applies to contracts and purchase orders that require the Contractor to comply with EM 385-1-1 (e.g. contracts that include the Accident Prevention Clause at FAR 52.236-13 and/or safety provisions). EM 385-1-1 and its changes are available at <http://www.hq.usace.army.mil> (at the HQ homepage, select Safety and Occupational Health and then select Changes to EM). The Contractor shall be responsible for complying with the current edition and all changes posted on the web as set in this solicitation.

1.3 ACCIDENT PREVENTION PROGRAM

Within fifteen (15) calendar days after receipt of Notice to Proceed, and at least ten (10) calendar days prior to the Preconstruction Safety Conference, four (4) copies of the Accident Prevention Plan shall be submitted for review and acceptance by the Contracting Officer or the Contracting Officers Representative (COR). The accident prevention program shall be prepared in the format outlined in Appendix A of EM 385-1-1, "Minimum Basic Requirements for Accident Prevention Plan".

1.4 HAZARD ANALYSIS

Prior to beginning each major phase of work, an Activity Hazard Analysis shall be prepared by the Contractor performing that work, and submitted for review and acceptance. The format shall be in accordance with EM 385-1-1, figure 1-2. A major phase of work is defined as an operation involving a type of work presenting hazards not experienced in previous operations or where a new contractor or work crew is to perform. (See Contractor Quality Control specification for further guidance regarding coordination of "Activities" and "Principal Steps" indicated in the Activity Hazard Analysis with Contractor Quality Control activities). The

analysis shall define the activities to be performed and identify the sequence of work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level. Work shall not proceed on that phase until the activity hazard analysis has been accepted and a preparatory meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activities, including the government on-site representative(s). The activity hazard analyses shall be continuously reviewed and when appropriate modified to address changing site conditions or operations, with the concurrence of the site safety representative, the site superintendent, and the Contracting Officer. Activity hazard analyses shall be attached to and become part of the accident prevention plan or may be developed prior to each phase of work undertaken in the contract and attached to the Quality Control reports.

3.1 Hazard analysis shall be used to identify and evaluate all substances, agents, or environments that present hazards and recommend control measures. Engineering and administrative controls shall be used to control hazards; in cases where engineering or administrative controls are not feasible, personal protective equipment may be used.

3.2 Information contained in MSDS (Material Safety Data Sheets) shall be incorporated in the hazard analysis for the activities in which hazardous or toxic materials will be used, or generated (e.g. fiberglass, crystalline silica, metal dust or fume, etc.)

1.5 SITE SAFETY OFFICER

The contractor shall identify an individual directly employed by the contractor as Site Safety Officer (SSO) responsible to the Contractor to implement and continually enforce the Accident Prevention Plan. The site safety officer shall not be the same individual as the Quality Control System Manager if the CQC System Manager is required to have no duties other than Quality Control. The site safety officer shall have the authority to suspend operational activities if the health and safety of personnel are endangered, and to suspend an individual from operational activities for infractions of the Accident Prevention Plan. Additional safety staff or alternate SSO may be assigned as determined by the Contractor. Alternate SSO must meet the same qualifications as the SSO.

The name, qualifications (training and experience) of the designated Site Safety Officer shall be included in the Accident Prevention Plan. The Site safety officer shall have the following qualifications:

- a. A minimum of 5 years construction experience with at least 2 years experience in implementing safety programs at construction work sites for projects of comparable scope and complexity.
- b. Documented experience in construction techniques and construction safety procedures.
- c. Working knowledge of Federal and state occupational health and safety regulations.

d. Specific training in excavation safety, fall protection, and confined space.

e. CPR/First Aid certification (current).

f. Familiarity with and ability to use and implement the Corps of Engineers Safety Manual EM 385-1-1.

g. Successful completion within last 5 years (or as required by OSHA) of 10-hour OSHA Construction Safety Class.

Other Requirements: Other sections of the contract documents may also require separate specially qualified individuals in such areas a chemical data acquisition, sampling and analysis, medical monitoring, industrial hygiene, quality control, etc. Contractor must comply with all safety requirements.

1.6 SITE INSPECTIONS

The site safety officer shall perform frequent inspections of the job sites and the work in progress to ensure compliance with EM 385-1-1 and to determine the effectiveness of the accident prevention plan. In addition, Quality Control personnel shall conduct and document daily safety inspections. Daily inspection logs shall be used to document inspections noting safety and health deficiencies, deficiencies in the effectiveness of the accident prevention plan, and corrective actions including timetable and responsibilities. The daily inspection logs will be attached to and submitted with the Daily Quality Control Reports or may be incorporated in the daily QQC report. Each entry shall include date, work area checked, employees present in work area, protective equipment and work equipment in use, special safety and health issues and notes, and signature of the preparer.

1.7 HIGHLIGHTED PROVISIONS

In addition to those items contained in EM 385-1-1, Appendix A, include the following items in the accident prevention plan:

1. Hard Hat Area. A statement that the jobsite is classified a "hard hat" area

2. Sanitation and Medical Requirements. Estimate the greatest number of employees, supervisors, etc., to be working at peak construction period, including subcontractor personnel. Include sanitation requirements and medical facilities identified for the job site. If a medical facility or physician is not accessible within five minutes of an injury to a group of two or more employees for the treatment of injuries, identify at least two or more employees on each shift who are qualified to administer first aid and CPR.

3. Equipment Inspection. The type of inspection program on cranes, trucks, and other types of construction equipment the Contractor plans to implement. Who will be responsible for the inspection and how the Contractor will control equipment of sub-contractors and equipment bought

to the site by rental companies. Types of records to be kept. Copies of records of all equipment inspections will be kept at the job site for review by the designated authority.

4. Crane & Derrick Operators: Written proof of qualification for all crane and derrick operators in accordance with EM 385-1-1, 16.C.05. Qualification shall be by written (or oral) examination and practical operating examination unless the operator is licensed by a state or city licensing agency for the particular type of crane or derrick. Proof of qualification shall be provided by the qualifying source.

1.8 ACCIDENT REPORTS

The contractor shall immediately report all accidents by telephone to the COR.

1. The Contractor will provide an initial written report of the accident to the COR within 24 hours. The Contractor shall complete and submit ENG Form 3394 for all accidents involving lost work time, medical treatment, and/or property damage in excess of \$2000.00 within 48 hours of the accident. The report shall accurately represent the circumstances of the accident, cause of the accident, extent of medical treatment, extent of injuries and steps to prevent occurrence of similar accidents. The hazard analysis covering the work activity being undertaken during the accident shall be attached to the report.

2. Daily records of all first aid treatment not otherwise reportable shall be maintained at the job site and furnished to the designated authority upon request. Records shall also be maintained of all exposure and accident experience incidental to the work (OSHA Form 300 or equivalent as prescribed by 29 CFR 1904).

1.9 MONTHLY EXPOSURE REPORTS

The Contractor shall submit to the COR no later than the 1st day of each month, a compilation of manhours worked each month by the prime contractor and each subcontractor. In addition, the contractor shall report the number of accidents, severity, class of accidents, and lost time work days for each month.

1.10 CLEAN-UP

The Contractor's Accident Prevention Plan shall identify the individual's responsible for cleanup and shall establish a regular housekeeping procedure and schedule. If the COR determines that cleanup is not being performed satisfactorily, the Contractor shall establish a work crew to perform the continuous cleanup required by the contract clause titled: CLEANING UP: The number of individuals appointed to the cleanup work crew shall be increased as required in order to render adequate cleanup.

1.11 FOCUS AREAS

To supplement and emphasize the requirements of EM 385-1-1, the following is provided and shall be met as applicable.

1. Electrical Work: Electrical work shall not be performed on or near energized lines or equipment unless specified in the plans and specifications and approved by the COR. Plan and layout of proposed temporary power to the construction site shall be submitted and approved by the COR before work will be permitted.

2. Upon request by the Contractor, arrangements will be made for de-energizing lines and equipment so that work may be performed. All outages shall be requested through the COR a minimum of 14 days, unless otherwise specified, prior to the beginning of the specified outages. Dates and duration will be specified.

3. If approved by the COR, the following work may be performed with the lines energized using certified hot line equipment on lines above 600 volts, when the following conditions have been met:

a. work below the conductors no closer than the clearance required in EM 385-1-1 from the energized conductors.

b. setting and connection of new pre-trimmed poles in energized lines which do not replace an existing pole.

c. setting and removing transformers or other equipment on poles.

d. installation or removal of hot line connectors, jumpers, dead-end insulators for temporary isolation, etc., which are accomplished with hot line equipment from an insulated bucket truck.

4. Energized Line Work Plan: The Contractor shall submit a plan, in writing, describing his/her method of operation and the equipment to be used on energized lines. Proper certification from an approved source of the safe condition of all tools and equipment will be provided with the plan. The work will be planned and scheduled so that proper supervision is maintained. Emergency procedures, including communication, for disconnecting power in the event of an accident will be outlined in the plan. The Contractor will review his/her plan with the COR prior to being granted permission to perform the work.

5. No work on lines greater than 600 volts will be performed from the pole or without the use of an insulated bucket truck.

6. No work will be done on overbuilt lines while underbuilt lines are energized, except for temporary isolation and switching.

7. Electrical Tools and Cords: Hand held electrical tools shall be used only on circuits protected by ground fault circuit interrupters for protection of personnel. All general use extension cords shall be hard usage or extra hard usage. Damaged or repaired cords shall not be permitted.

8. Temporary electrical distribution systems and devices shall be checked and found acceptable for polarity, ground continuity, and ground resistance before initial use and after modification. GFI outlets shall be installed

and tested with a GFI circuit tester (tripping device) prior to use. Portable and vehicle mounted generators shall be inspected for compliance with EM 385-1-1 and NFPA 70. All electrical equipment located outdoors or in wet locations shall be enclosed in weatherproof enclosures in accordance with EM 385-1-1. Records of all tests and inspections will be kept by the contractor and made available on site for review by the designated authority. Submit sketch of proposed temporary power for acceptance.

9. Seat belts and ROPS shall be installed on all construction equipment. The operating authority will furnish proof from the manufacturer or licensed engineer that ROPS meets the applicable SAE standards cited in EM 385-1-1, pg. 302.

10. Radiation Permits or Authorizations: Contractors contemplating the use of a licensed or DOD regulated radiological device or radioactive material on a DOD installation will secure appropriate permit or authorization from the Department of Army or Department of the Air Force, as applicable. A 45-day lead-time should be programmed for obtaining the necessary authorization or permit. When requested, the COR will assist the Contractor in obtaining the required permit or authorization.

11. The Contractor shall develop and implement a radiation safety program to comply with EM 385-1-1, Section 06.E. Provisions for leak tests, authorized personnel, transport certificates, etc. will be addressed in the radiation safety program.

12. Elevating Work Platforms: All elevating work platforms shall be designed, constructed, maintained, used, and operated in accordance with ANSI A92.3, ANSI A92.6, ANSI A92.5 and EM 385-1-1, Sections 22.J.

13. Only personnel trained in the use of elevating work platforms shall be authorized to use them. A list of authorized users will be maintained by the contractor at the job site. The list will be updated to remain current and made available for review on site by the designated authority. Personnel safety belts must be worn.

14. Fall Protection: Fall protection in the form of standard guardrails, nets, or personal fall arrest systems will be provided for all work conducted over 6 feet in height. The contractor will submit his/her proposed method of fall protection to the COR as part of the Job Hazard Analysis for acceptance. If the contractor deems that conventional fall protection as described above is not feasible, or creates a greater hazard, the Contractor will prepare a written fall protection plan in accordance with OSHA 29 CFR 1926.502(k). The plan will demonstrate the reasons that conventional fall protection is unfeasible or constitutes a greater hazard and will provide alternative safety measures for review and acceptance by the COR.

15. Excavations: All open excavations made in the earth's surface four (4) foot or greater will be under the supervision of a competent person trained in, and knowledgeable about, soils analysis, the use of protective systems, and the requirements of OSHA 29 CFR 1926, Subpart P and EM 385-1-1, Section 25. The competent person shall be designated in writing by the Contractor and a resume of their training and experience submitted

to the COR for acceptance.

a. Excavations hazards and methods for their control will be specified in the job hazard analysis.

b. Sloping and benching: The design of sloping and benching shall be selected from and in accordance with written tabulated data, such as charts and tables. At least one copy of the tabulated data will be maintained at the job site.

c. Support Systems: shall be in accordance with one of the systems outlined in a through c below:

1. Designs drawn from manufacturer's specifications and in accordance with all specifications, limitations, and recommendations issued or made by the manufacturer. A copy of the manufacture's specifications, recommendations, and limitations will be in written form and maintained at the job site.

2. Designed by a registered engineer. At least one copy of the design shall be maintained at the job site during excavation.

3. Designs selected from and in accordance with tabulated data (such as tables and charts). At least one copy of the design shall be maintained at the job site during excavation

d. Excavations Greater than 20 Feet in Height: Sloping and benching or support systems shall be designed by a registered professional engineer. Designs shall be in writing and at least one copy of the design shall be maintained at the job site during excavation. The contractor will ensure that the registered professional engineer is working within a discipline applicable to the excavation work; i.e. it would be inappropriate for an electrical engineer to approve shoring designed for an excavation.

16. Confined Space: Entry into and work in a confined space will not be allowed when oxygen readings are less than 19.5% or greater than 23.5% or if the lower explosive limit (LEL) reading is greater than 10%, unless these conditions are adequately addressed in the confined space entry plan. In addition, action levels for toxic atmospheres shall be determined and any other known or potential hazards eliminated prior to entry.

1.12 LANGUAGE

For each group that has employees that do not speak English, the Contractor will provide a bilingual foreman that is fluent in the language of the workers. The contractor will implement the requirements of EM 385-1-1, 01.B through these foremen.

1.13 CONTRACTOR SAFETY MEETINGS AND DOCUMENTATION

Contractor shall conduct and document safety meetings among its personnel as required by EM 385-1-1 and as indicated herein. Monthly meetings shall be held among all supervisors, and weekly meetings shall be conducted by supervisors or foreman for all workers. The agenda of the meeting shall

include specific safety items pertinent to work being performed. Documentation shall include a summary of items discussed as well as other items required by the EM 385-1-1. Documentation shall be submitted to the Government monthly.

1.14 COORDINATION WITH OTHER SPECIFICATION SECTIONS

The requirements of this section are meant to supplement requirements of other sections. In cases of discrepancies the most stringent requirements shall apply. Other safety-related requirements can be found in the following specification sections:

- a. Specification Section 00800, Special Contract Requirements
- b. Specification Section 00700, Contract Clauses, paragraph entitled "accident Prevention"
- c. Specification Section entitled "Contractor Quality Control"
- d. Other specifications or contract requirements relating to site safety or health requirement or medical monitoring.

1.15 CONTRACTOR PERFORMANCE APPRAISAL

The occurrence of accidents and near misses due to negligence are strong indications that there has been insufficient emphasis on effective implementation and/or commitment to the accident prevention program. Should it become obvious that only lip service is being given to this program, an interim unsatisfactory performance appraisal rating will be issued. If safety continues to be unsatisfactory or marginal, the unsatisfactory rating will become final. The contractor should be aware that this appraisal will be stored in a national computer database which can be accessed by a multitude of agencies or municipalities desiring information on prospective contractors. An unsatisfactory rating in this database may affect the contractor's ability to obtain future Government work.

PART 2 PRODUCTS (Not applicable)

PART 3 EXECUTION (Not applicable)
-- End of Section --

SECTION 01451A

CONTRACTOR QUALITY CONTROL
NYD Edition 12/99

PART 1 GENERAL

1.1 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause entitled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and off site, and shall be keyed to the proposed construction sequence. For purposes of this section the term "construction" shall include all items of work, activities, materials and equipment as indicated in the contract documents. Other sections of the contract documents may also require separate, specially qualified individuals in such areas as chemical data acquisition, sampling and analysis, medical monitoring, industrial hygiene, safety officer, etc. The CQC organization will coordinate the activities of these individuals. The project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with quality requirements specified in the contract. The project superintendent in this context shall mean the on-site individual with the responsibility for the overall management of the project including logistics and production.

3.2 QUALITY CONTROL PLAN

3.2.1 General

The Contractor shall furnish for review by the Government, not later than 90 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause entitled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. The Government will consider an interim plan for the first 90 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of

work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.2.2 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and off site, including work by subcontractors, fabricator, suppliers, and purchasing agents:

a. A description of the quality control organization, including a chart showing

lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to an officer in the Contractor's organization above the Project Superintendent, who is responsible for both quality and production.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function. Clear indication that CQC System Manager will have no duties other than Quality Control.

c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters will also be furnished to the Government.

d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, off site fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01330 SUBMITTAL PROCEDURES.

e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.) The Contractor shall incorporate all tests required by the contract (including systems commissioning and operating tests) to derive the above list of testing information which shall be presented in matrix form as part of the CQC Plan. This matrix shall be suitable for use by the Contractor and the Government as a checklist to control testing to be done on the contract. Coordinate any additional test submission or plan requirements for Mechanical and Electrical Systems with appropriate specialized specification section if applicable.

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation. Provide matrix of Preparatory and Initial Inspections including specification reference paragraph, the name of the Definable

Feature of Work, and spaces for date performed, results, and names of attendees.

g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and has separate control requirements. It could be identified by different trades or disciplines, or it could be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there is frequently more than one definable feature under a particular section. This list will cover all features of work on the project, and will be agreed upon during the coordination meeting.

j. A brief explanation of the duties of the CQC organization with respect to safety. Note that separate Accident Prevention Plan and Hazards Analysis is required for submission and acceptance.

k. Contractor's plan for training all CQC personnel in the CQC System.

3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Pre-construction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 14 calendar days prior to the Coordination Meeting.

The initial plan submitted must be found acceptable by the Government before the Coordination Meeting can be held. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and off site work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared

by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 General

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure contract compliance. The number of CQC personnel shall be increased as required during times of high construction workload. The Contractor shall provide a CQC organization which shall be at the site at all times during progress of the work and with complete authority to take any action necessary to ensure compliance with the contract. All CQC staff members shall be subject to acceptance by the Contracting Officer.

3.4.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within his organization at the site of the work who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a graduate engineer, graduate architect, or a graduate of construction management, or shall hold a state Professional Engineer's license, with a minimum of 2 years construction experience on construction similar to this contract, one year of which as a Quality Control Representative. The CQC Manager may also be a construction person with a minimum of 4 years in related work, one year of which as a QC Representative. This CQC System Manager shall be on the site at all times during construction and will be employed by the prime Contractor. An alternate for the CQC System Manager will be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate will be the same as for the designated CQC System Manager. The CQC System Manager shall be assigned no duties other than Quality Control.

3.4.3 Organizational Expertise

The CQC organization, which includes the CQC System Manager and additional qualified personnel, must as a minimum possess general corporate technical knowledge of all aspects of the project, and must successfully execute the CQC System on all aspects of the project. Individuals possessing experience in specialized areas shall be added to the organization as required during periods when such specialty areas are being executed. Examples of such specialized areas would include HVAC, electrical distribution and substations, roofing, tele-communication systems, fire protection and alarm systems, computer installations, specialized welding, specialized finishes, precast concrete installation, modular housing, specialized geotech work, dredging, sand placement and surveying, chemical data acquisition, hazardous material removal and disposal, medical monitoring, etc., depending on the nature of the particular project. The Contractor must demonstrate that such additional qualified personnel

have received sufficient training and indoctrination into the CQC system, and that these personnel properly execute the requirements of the CQC System within their areas of expertise.

3.4.4 Additional Requirement

In addition to the above experience and education requirements the CQC System Manager shall have completed within the last five years the course entitled "Construction Quality Management for Contractors". This course is given at a cost of \$25 by Government personnel and is of two-day duration. The Government will provide one instruction manual for the course.

3.4.5 Organizational Changes

The Contractor shall maintain the CQC Organization at full strength at all times. When it is necessary to make changes to the organization, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS

Submittals shall be made as specified in Section 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements and are submitted in accordance with the date on the submittal register. CQC personnel shall also make physical checks of materials and equipment before installation to insure compliance with approved shop drawings.

3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of work as follows:

3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work after all required plans/documents/materials are approved/accepted, and after copies are at the worksite, and shall include:

- a. A review of each paragraph of applicable specifications.
- b. A review of the contract drawings.
- c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
- d. Review of provisions that have been made to provide required control inspection and testing.
- e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

g. A review of the appropriate activity hazard analysis to assure safety requirements are met per EM 385-1-1, "Safety and Health Requirements Manual".

h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

j. Discussion of the initial control phase.

k. The Government shall be notified at least 48 hours in advance of beginning the preparatory control phase meeting. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall clearly indicate its intent and plan for communication of the results of the preparatory phase to applicable workers, to include materials, construction methods, workmanship standards, safety considerations and procedures, and preparatory phase meeting minutes.

3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work (DFW) when the accomplishment of a representative sample of the work is impending.

The following shall be accomplished:

a. A check of the portion of work done to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve all differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each

worker.

f. The Government shall be notified at least 48 hours in advance of beginning the initial phase meeting. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), the foreman responsible for the definable feature and the work crew(s) for the appropriate DFW. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location (i.e. CQC Report number) of initial phase shall be indicated for future reference and comparison with follow-up phases.

3.6.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon or conceal non-conforming work.

3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable feature of work if the quality of on-going work is unacceptable, if there are changes in the applicable CQC staff, onsite production supervision or work crew, if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.6.5 Definable Feature of Work: Definition and Discussion

A Definable Feature of Work (DFW) is a portion of work consisting of materials, equipment, supplies and procedures which are closely related to each other, have the same control and will be accomplished by the same work crew to completion. A DFW must be sufficiently small so that control of the work (i.e. communication of requirements to workers, inspection of materials and workmanship and correction of deficiencies) will be easily accomplished. Some examples for various types of projects are:

- * Rough-in of electrical boxes and wiring methods
- * Lighting fixtures, receptacles, and accessories
- * Panelboards, circuit breakers and motors.
- * Water supply piping, fittings and supports
- * DWV piping, fittings and supports for plumbing
- * Concrete reinforcement and formwork
- * Concrete mixing, placement, curing and finishing

- * Testing Procedure for contaminated soil, materials and storage tank contents

- * Storage Tank disassembly and removal

- * Setting up of decontamination area, exclusion zones and standard safety procedures for asbestos removal

- * Asbestos removal and disposal procedures

- * Chemical Data Acquisition

- * Preparation, removal and disposal of contaminated material

- * Dredging and placement.

3.7 TESTS

3.7.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a laboratory which has been assurance inspected by the Corps of Engineers within the last two years. The Contractor shall perform the following activities and record and provide the following data:

- a. Verify that testing procedures comply with contract requirements.

- b. Verify that facilities and testing equipment are available and comply with testing standards.

- c. Check test instrument calibration data against certified standards.

- d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

- e. Results of all tests taken, both passing and failing tests, will be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test will be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an off site or commercial test facility will be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2 Testing Laboratories

3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment and calibration in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, aggregate and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329. The Government requires a Corps of Engineers capability check of the laboratory which the contractor proposes to perform tests on soils, concrete, asphalt, aggregate and steel. If the laboratory proposed has not had the required Corps of Engineers capability check within the last two years, it will be performed by the Corps of Engineers at a cost of \$7200 to the contractor. This cost will be paid by the Contractor via check directly to the Corps of Engineers Laboratory performing the inspection and report.

3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge of \$7200 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory.

3.7.3 On-Site Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials will be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineers Division Laboratory, as designated by the Government Representative. Coordination for each specific test, exact delivery location and dates will be made through the Area Office.

3.8 COMPLETION INSPECTION

3.8.1 Punch-Out Inspection

Near the completion of all work or any increment thereof established by a completion time stated in the Special Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the CQC System Manager shall conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second

inspection to ascertain that all deficiencies have been corrected. Once this is accomplished the Contractor shall notify the Government that the facility is ready for the Government's "Pre-final" inspection.

3.8.2 Pre-Final Inspection

The Government will perform this inspection to verify that the facility is ready to be occupied. A Government "Pre-final Punch List" will be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected and so notify the Government so that a "Final" inspection with the customer can be scheduled.

Any items noted on the "Pre-final" inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph will be accomplished within the time slated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates.

3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person and the Contracting Officer's Representative will be in attendance at this inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final Inspection. Notice will be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being acceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause entitled "Inspection of Construction".

3.9 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

- a. Contractor/subcontractor and their area of responsibility.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.

e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.

f. Submittals reviewed, with contract reference, by whom, and action taken.

g. Off-site surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. Instructions given/received and conflicts in plans and/or specifications.

j. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. "N/A" shall be entered into any field for which no entry is intended. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 16 hours after the date(s) covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every seven days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel. All documentation is expected to be literate, legible and complete.

3.10 SAMPLE FORMS

(Note: If the Quality Control System (QCS) (formally called Resident Management System (RMS)) is required to be used by the contractor for the QC System as indicated elsewhere in this contract, Contractor will generate all reports in the QCS System, and attached forms will serve as guidance only. Otherwise forms contained herein will be used by the CQC Staff for CQC System reporting).

a. The 2-page form at the end of the section will be used for the basic CQC Report. CQC personnel shall attach continuation sheets as required for any entries which cannot fit on the basic form. Preparatory and Initial Inspections, when performed, shall be indicated on the basic CQC report and

minutes for each inspection shall be attached. Minutes will consist of a list of specific requirements for materials, procedures or equipment to be employed and shall also include any understandings reached or items of special importance discussed.

b. In addition, outstanding deficiencies shall be listed on the form "List of Outstanding Deficiencies" at the end of this section and shall be attached to each CQC report. As deficiencies are corrected, they are to be acknowledged on the basic CQC report and shall be deleted from the list.

c. Form at the end of this section entitled "CQC Test Report List" shall be used by the Contractor to track testing to be done as the project progresses, and also to summarize the Contractor's Quality Control testing to be reported on the CQC Plan.

d. Form "Record of Preparatory and Initial Inspections" at the end of this section shall be used by the Contractor to track Preparatory and Initial inspections as the project progresses and also to summarize these required inspections as part of the CQC Plan.

e. Additional reporting forms pertaining to specialized activities may be included herein or elsewhere in the contract, and shall be used for reporting as indicated.

3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor. Deficiencies cited and verbal instructions given to the Contractor by the Government Representative shall be entered into that day's CQC Report.

(FORMS FOLLOW)

-- End of Section --

SECTION 01452

TESTING FOR MECHANICAL AND ELECTRICAL SYSTEMS
NY Dist. Sept. 2003

PART 1 GENERAL

1.1 APPLICABILITY

This section applies to all mechanical and electrical systems and all systems using electromagnetically driven equipment, pneumatic or electronic systems; high and low voltage electrical distribution systems (except branch panels) and to any system which incorporates this section into other parts of the specification by reference. For purposes of this section a "system" is an entity comprised of a series of closely related interdependent components and which is capable of independent performance of a useful function. System components shall include all software and programming as applicable for the system. Some typical examples include:

- a. Independently functioning HVAC Systems.
- b. Fire Alarm Systems.
- c. Public Address Systems.
- d. Sprinkler Systems including alarms.
- e. Telephone Systems including line protectors, splices cables, switching equipment, outlets and instruments.
- f. Intrusion Detection System.
- g. High Voltage Equipment including cable, splices, switchgear, relays, circuit breakers, fuses, transformers, instrumentation, etc.
- h. Low Voltage Switchboard including incoming and outgoing feeders, circuit protection and all accessories.

1.2 TEST PLAN

a. Not later than sixty days after Notice to Proceed, in accordance with Section "Submittals" and other paragraphs of the technical provisions, the Contractor shall submit a list for approval consisting of all systems for which test plans are required. This list will be reviewed by the Government and any systems found to be missing will be required to be added by the Contractor, and appropriate test plans submitted. No work will be permitted on any of the above systems until this list is submitted.

b. The Contractor shall develop test plans and schedule operational testing for the systems in the approved list. The testing shall be in accordance with the requirements in the appropriate technical provisions and shall include as a minimum the requirements below. All testing required by applicable codes, standards, utility companies, manufacturers,

suppliers, etc. shall be incorporated into the Contractor's test plans. Test plans shall list all equipment required to perform the tests, and any Government support required. It shall be in sufficient detail to permit a step-by-step approach to the test and to demonstrate that the systems operate as intended by the contract documents. It shall describe as a minimum:

1. What system is being tested including a listing of all components to be tested.

2. What individual or organization will perform testing, who will certify the tests, and qualifications of test personnel.

3. A step by step narrative of the testing procedure to be used to demonstrate contract compliance including all governing standards, such as "sequence of controls", "ASTM Standard XXX"; or IEEE Standard XXX", etc.

4. What testing equipment will be utilized.

5. What operator interaction is required.

6. What results are to be expected.

7. Seasonal limitations, if any, including date(s) of proposed testing.

8. A complete schematic diagram (electrical, pneumatic) showing all components, and block diagram.

9. A checklist shall be developed to be used during the operational test.

c. Test plans shall be submitted for approval for all systems contained on the list submitted per para. 2a above. It is also desirable to submit all test plans as soon as possible so that the progress of the project and corresponding payments will proceed on schedule.

1.3 TESTING PROCESS

a. Outlined below are a number of events relating to the status of the test plan and testing. The corresponding percentages indicate the maximum percentage of the value of the system which will be permitted to be installed after the successful completion of the corresponding event indicated, for all systems to which this section applies. Events must be completed sequentially. Any work performed in excess of the permitted percentages will be at the Contractor's own risk and will not be paid until the event corresponding to the percentage of system value permitted to be installed is successfully completed:

EVENT	MAX. % of SYSTEM VALUE PERMITTED TO BE INSTALLED
1. Contractor has submitted list of systems that require test plans to be approved, and system work is	50

ongoing but no test plan submitted.

2. Test Plan Submitted	65
3. *Test Plan Approved	80
4. Successful completion of tests including submission of required documents, reports (i.e. balancing reports for all HVAC Systems), Operation and Maintenance Manuals spare parts, and spare parts data.	**100

* The Government will process the submittal in accordance with the time frames indicated in the specification section "Submittals". If the test plan is disapproved the Government has an additional 30 days to review the resubmittal from the date it receives the resubmittal.

**If a system involves both heating and cooling modes and one mode has been successfully tested this percentage shall be reduced to 90% until the testing is completed.

b. The Contractor may proceed with events as indicated in the above table for each system separately.

1.4 OPERATIONAL TESTS

Operational tests including performance tests shall be conducted for an entire system, not component parts only. Tests may be conducted only after an entire system has been completely installed. Contractor shall provide a minimum of 14 days notice to the Contracting Officer of scheduled tests. This notice must include the Contractor's assurance that all installed work previously identified to the Contractor as being unacceptable along with all remaining work associated with the respective system will be complete and acceptable by the date scheduled for the operational test. Failure of the Contractor to have all contract work acceptably complete for this test will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection costs.

1.5 TESTING QUALIFICATIONS

For each system the Contractor shall obtain the services of an experienced professional who shall certify that the operational test was conducted in accordance with the approved test plan and the results of this test meet all the contract requirements. These individuals must have a minimum of eight years experience in the testing of the particular system being tested and shall also meet qualifications (if any) set forth in other technical sections of the contract specifications.

1.6 COMPONENTS

When considering the value of a system for payment purposes the following components shall be counted as part of a "system": All electromagnetically

driven equipment; pneumatic or electric control system; gauges, dampers, valves, actuators, controllers, pipes, test sensing elements, logic/processors, CPU's, ducts, insulation, wiring, conduit, switchgear, and all other mechanical or electrical components, devices or equipment which are essential to the proper function of the system such as pumps, motors, air handling units, chillers, cooling towers, etc. Software programs and any refrigerants are also considered "parts" of a system.

1.7 TESTING CONFLICTS

The requirements contained in this section supplement other testing requirements contained in the contract documents. If a conflict exists between the requirements of this section and other parts of the contract documents, the requirements of this section shall take precedence.

PART 2 PRODUCTS Not Applicable

PART 3 EXECUTION Not Applicable

-- End of Section --

SECTION 01572

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT
02/03

PART 1 GENERAL

1.1 GOVERNMENT POLICY

Government policy is to apply sound environmental principles in the design, construction and use of facilities. As part of the implementation of that policy the Contractor shall: (1) practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction and demolition waste from landfills and incinerators and to facilitate their recycling or reuse.

1.2 MANAGEMENT

The Contractor shall take a pro-active, responsible role in the management of construction and demolition waste and require all subcontractors, vendors, and suppliers to participate in the effort. Construction and demolition waste includes products of demolition or removal, excess or unusable construction materials, packaging materials for construction products, and other materials generated during the construction process but not incorporated into the work. In the management of waste consideration shall be given to the availability of viable markets, the condition of the material, the ability to provide the material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates. The Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling of waste. Revenues or other savings obtained for salvage, or recycling shall accrue to the Contractor. Firms and facilities used for recycling, reuse, and disposal shall be appropriately permitted for the intended use to the extent required by federal and local regulations.

1.3 PLAN

A waste management plan shall be submitted within 15 days after notice to proceed and prior to initiating any site preparation work. The plan shall include the following:

- a. Name of individuals on the Contractor's staff responsible for waste prevention and management.
- b. Actions that will be taken to reduce solid waste generation.
- c. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas and equipment to be used for processing, sorting, and temporary storage of wastes.

- d. Characterization, including estimated types and quantities, of the waste to be generated.
- e. Name of landfill and/or incinerator to be used and the estimated costs for use, assuming that there would be no salvage or recycling on the project.
- f. Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and organizations that accept used materials such as materials exchange networks and Habitat for Humanity.
- g. List of specific waste materials that will be salvaged for resale, salvaged and reused, or recycled. Recycling facilities that will be used shall be identified.
- h. Identification of materials that cannot be recycled/reused with an explanation or justification.
- i. Anticipated net cost savings determined by subtracting Contractor program management costs and the cost of disposal from the revenue generated by sale of the materials and the incineration and/or landfill cost avoidance.

1.4 RECORDS

Records shall be maintained to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. The records shall be made available to the Contracting Officer during construction, and a copy of the records shall be delivered to the Contracting Officer upon completion of the construction.

1.5 COLLECTION

The necessary containers, bins and storage areas to facilitate effective waste management shall be provided and shall be clearly and appropriately identified. Recyclable materials shall be handled to prevent contamination of materials from incompatible products and materials and separated by one of the following methods:

1.5.1 Source Separated Method.

Waste products and materials that are recyclable shall be separated from trash and sorted into appropriately marked separate containers and then transported to the respective recycling facility for further processing.

1.5.2 Co-Mingled Method.

Waste products and recyclable materials shall be placed into a single container and then transported to a recycling facility where the recyclable materials are sorted and processed.

1.5.3 Other Methods.

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

1.6 DISPOSAL

Except as otherwise specified in other sections of the specifications, disposal shall be in accordance with the following:

1.6.1 Reuse.

First consideration shall be given to salvage for reuse since little or no re-processing is necessary for this method, and less pollution is created when items are reused in their original form. Sale or donation of waste suitable for reuse shall be considered. Salvaged materials, other than those specified in other sections to be salvaged and reinstalled, shall not be used in this project.

1.6.2 Recycle.

Waste materials not suitable for reuse, but having value as being recyclable, shall be made available for recycling whenever economically feasible.

1.6.3 Waste.

Materials with no practical use or economic benefit shall be disposed at a landfill or incinerator. Disposal by landfill or incineration on the installation should not be provided as a "no Cost" item. If necessary to use such facilities the Contractor shall be charged the prevailing commercial rate.

-- End of Section --

SECTION 01670

RECYCLED / RECOVERED MATERIALS

12/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247

Comprehensive Procurement Guideline for
Products Containing Recovered Materials

1.2 OBJECTIVES

Government procurement policy is to acquire, in a cost effective manner, items containing the highest percentage of recycled and recovered materials practicable consistent with maintaining a satisfactory level of competition without adversely affecting performance requirements or exposing suppliers' employees to undue hazards from the recovered materials. The Environmental Protection Agency (EPA) has designated certain items which must contain a specified percent range of recovered or recycled materials. EPA designated products specified in this contract comply with the stated policy and with the EPA guidelines. The Contractor shall make all reasonable efforts to use recycled and recovered materials in providing the EPA designated products and in otherwise utilizing recycled and recovered materials in the execution of the work.

1.3 EPA DESIGNATED ITEMS INCORPORATED IN THE WORK

Various sections of the specifications contain requirements for materials that have been designated by EPA as being products which are or can be made with recovered or recycled materials. These items, when incorporated into the work under this contract, shall contain at least the specified percentage of recycled or recovered materials unless adequate justification (non-availability) for non-use is provided. When a designated item is specified as an option to a non-designated item, the designated item requirements apply only if the designated item is used in the work.

1.4 EPA PROPOSED ITEMS INCORPORATED IN THE WORK

Products other than those designated by EPA are still being researched and are being considered for future Comprehensive Procurement Guideline (CPG) designation. It is recommended that these items, when incorporated in the work under this contract, contain the highest practicable percentage of

recycled or recovered materials, provided specified requirements are also met.

1.5 EPA LISTED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN THE WORK

There are many products listed in 40 CFR 247 which have been designated or proposed by EPA to include recycled or recovered materials that may be used by the Contractor in performing the work but will not be incorporated into the work. These products include office products, temporary traffic control products, and pallets. It is recommended that these non-construction products, when used in the conduct of the work, contain the highest practicable percentage of recycled or recovered materials and that these products be recycled when no longer needed.

-- End of Section --

SECTION 01780A

CLOSEOUT SUBMITTALS

05/02

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

As-Built Drawing

Drawings showing final as-built conditions of the project. The final CADD as-built drawings shall consist of one set of electronic CADD drawing files in the specified format, one set of mylar drawings, 2 sets of blue-line prints of the mylars, and one set of the approved working as-built drawings.

SD-03 Product Data

As-Built Record of Equipment and Material

Two copies of the record listing the as-built materials and equipment incorporated into the construction of the project.

Warranty Management Plan

Two sets of the warranty management plan containing information relevant to the warranty of materials and equipment incorporated into the construction project, including the starting date of warranty of construction. The Contractor shall furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.

Warranty Tags

Two record copies of the warranty tags showing the layout and design.

Final Cleaning

Two copies of the listing of completed final clean-up items.

1.2 PROJECT RECORD DOCUMENTS

1.2.1 As-Built Drawings

This paragraph covers as-built drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working as-built drawings" and "final as-built drawings" refer to contract drawings which are revised to be used for final as-built drawings.

1.2.1.1 Government Furnished Materials

One set of electronic CADD files in the specified software and format revised to reflect all bid amendments will be provided by the Government at the preconstruction conference for projects requiring CADD file as-built drawings.

1.2.1.2 Working As-Built and Final As-Built Drawings

The Contractor shall revise 2 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. These working as-built marked drawings shall be kept current on a weekly basis and at least one set shall be available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes.

Final as-built drawings shall be prepared after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working as-built marked prints and final as-built drawings will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor prior to submission of each monthly pay estimate. If the Contractor fails to maintain the working and final as-built drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the as-built drawings. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of updated drawings. The working and final as-built drawings shall show, but shall not be limited to, the following information:

- a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensioning along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

- b. The location and dimensions of any changes within the building structure.

- c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract

plans.

d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

f. Changes or modifications which result from the final inspection.

g. Where contract drawings or specifications present options, only the option selected for construction shall be shown on the final as-built prints.

h. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, the Contractor shall furnish a contour map of the final borrow pit/spoil area elevations.

i. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, and fire sprinkler.

j. Modifications (change order price shall include the Contractor's cost to change working and final as-built drawings to reflect modifications) and compliance with the following procedures.

(1) Directions in the modification for posting descriptive changes shall be followed.

(2) A Modification Circle shall be placed at the location of each deletion.

(3) For new details or sections which are added to a drawing, a Modification Circle shall be placed by the detail or section title.

(4) For minor changes, a Modification Circle shall be placed by the area changed on the drawing (each location).

(5) For major changes to a drawing, a Modification Circle shall be placed by the title of the affected plan, section, or detail at each location.

(6) For changes to schedules or drawings, a Modification Circle shall be placed either by the schedule heading or by the change in the schedule.

(7) The Modification Circle size shall be 12.7 mm diameter unless the area where the circle is to be placed is crowded. Smaller size circle shall be used for crowded areas.

1.2.1.3 Drawing Preparation

The as-built drawings shall be modified as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract set into agreement with approved working as-built prints, and adding such additional drawings as may be necessary. These working as-built marked prints shall be neat, legible and accurate. These drawings are part of the permanent records of this project and shall be returned to the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at no expense to the Government.

1.2.1.4 Computer Aided Design and Drafting (CADD) Drawings

Only personnel proficient in the preparation of CADD drawings shall be employed to modify the contract drawings or prepare additional new drawings. Additions and corrections to the contract drawings shall be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols shall be the same as the original line colors, line weights, lettering, layering conventions, and symbols. If additional drawings are required, they shall be prepared using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final as-built drawings shall be identical to that used on the contract drawings. Additions and corrections to the contract drawings shall be accomplished using CADD files. The Contractor will be furnished "as-designed" drawings in AutoCad Release 2004 format compatible with a Windows 2000 operating system. The electronic files will be supplied on compact disc, read-only memory (CD-ROM). The Contractor shall be responsible for providing all program files and hardware necessary to prepare final as-built drawings. The Contracting Officer will review final as-built drawings for accuracy and the Contractor shall make required corrections, changes, additions, and deletions.

a. CADD colors shall be the "base" colors of red, green, and blue. Color code for changes shall be as follows:

- (1) Deletions (red) - Deleted graphic items (lines) shall be colored red with red lettering in notes and leaders.
- (2) Additions (Green) - Added items shall be drawn in green with green lettering in notes and leaders.
- (3) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes shall be in blue.

b. The Contract Drawing files shall be renamed in a manner related to the contract number (i.e., 98-C-10.DGN) as instructed in the Pre-Construction conference. Marked-up changes shall be made only to those renamed files. All changes shall be made on the layer/level as the original item. There shall be no deletions of existing lines; existing lines shall be over struck in red. Additions shall be in green with line weights the same as the drawing. Special notes shall be in blue on layer

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c. When final revisions have been completed, the cover sheet drawing shall show the wording "RECORD DRAWING AS-BUILT" followed by the name of the Contractor in letters at least 5 mm high. All other contract drawings shall be marked either "AS-Built" drawing denoting no revisions on the sheet or "Revised As-Built" denoting one or more revisions. Original contract drawings shall be dated in the revision block.

d. Within 20 days for contracts \$5 million and above after Government approval of all of the working as-built drawings for a phase of work, the Contractor shall prepare the final CADD as-built drawings for that phase of work and submit two sets of blue-lined prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days for contracts \$5 million and above the Contractor shall revise the CADD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 20 days for contracts \$5 million and above of substantial completion of all phases of work, the Contractor shall submit the final as-built drawing package for the entire project. The submittal shall consist of one set of electronic files on compact disc, read-only memory (CD-ROM), one set of mylars, two sets of blue-line prints and one set of the approved working as-built drawings. They shall be complete in all details and identical in form and function to the contract drawing files supplied by the Government. Any transactions or adjustments necessary to accomplish this is the responsibility of the Contractor. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CADD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final as-built drawing files and marked prints as specified shall be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final as-built drawings shall be accomplished before final payment is made to the Contractor.

1.2.1.5 Payment

No separate payment will be made for as-built drawings required under this contract, and all costs accrued in connection with such drawings shall be considered a subsidiary obligation of the Contractor.

1.2.2 As-Built Record of Equipment and Materials

The Contractor shall furnish one copy of preliminary record of equipment and materials used on the project 15 days prior to final inspection. This preliminary submittal will be reviewed and returned 2 days after final inspection with Government comments. Two sets of final record of equipment and materials shall be submitted 10 days after final inspection. The designations shall be keyed to the related area depicted on the contract drawings. The record shall list the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA

Description	Specification	Manufacturer	Composition	Where
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RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA

Section	and Catalog,	and Size	Used
	Model, and		
	Serial Number		

1.2.3 Final Approved Shop Drawings

The Contractor shall furnish final approved project shop drawings 30 days after transfer of the completed facility.

1.2.4 Construction Contract Specifications

The Contractor shall furnish final as-built construction contract specifications, including modifications thereto, 30 days after transfer of the completed facility.

1.2.5 Real Property Equipment

The Contractor shall furnish a list of installed equipment furnished under this contract. The list shall include all information usually listed on manufacturer's name plate. The "EQUIPMENT-IN-PLACE LIST" shall include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. A draft list shall be furnished at time of transfer. The final list shall be furnished 30 days after transfer of the completed facility.

1.3 WARRANTY MANAGEMENT

1.3.1 Warranty Management Plan

The Contractor shall develop a warranty management plan which shall contain information relevant to the clause Warranty of Construction in PENDING. At least 30 days before the planned pre-warranty conference, the Contractor shall submit the warranty management plan for Government approval. The warranty management plan shall include all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan shall be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below shall include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase shall be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Approved information shall be assembled in a binder and shall be turned over to the Government upon acceptance of the work. The construction warranty period shall begin on the date of project acceptance and shall continue for the full product warranty period. A joint 4 month and 9 month warranty inspection shall be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Information contained in the warranty management plan

shall include, but shall not be limited to, the following:

a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.

b. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.

c. A list for each warranted equipment, item, feature of construction or system indicating:

1. Name of item.
2. Model and serial numbers.
3. Location where installed.
4. Name and phone numbers of manufacturers or suppliers.
5. Names, addresses and telephone numbers of sources of spare parts.
6. Warranties and terms of warranty. This shall include one-year overall warranty of construction. Items which have extended warranties shall be indicated with separate warranty expiration dates.
7. Cross-reference to warranty certificates as applicable.
8. Starting point and duration of warranty period.
9. Summary of maintenance procedures required to continue the warranty in force.
10. Cross-reference to specific pertinent Operation and Maintenance manuals.
11. Organization, names and phone numbers of persons to call for warranty service.
12. Typical response time and repair time expected for various warranted equipment.

d. The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

e. Procedure and status of tagging of all equipment covered by extended warranties.

f. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

1.3.2 Performance Bond

The Contractor's Performance Bond shall remain effective throughout the construction period.

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred

by the Government while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, the Contractor shall respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

1.3.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor shall furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, shall be continuously available, and shall be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

1.3.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, the Contractor shall respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. The Contractor shall submit a report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframes specified, the Government will perform the work and backcharge the construction warranty payment item established.

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

d. The "Construction Warranty Service Priority List" is as follows:

Code 1-Air Conditioning Systems

- (1) Air conditioning leak in part of building, if causing damage.
- (2) Air conditioning system not cooling properly.

Code 1-Doors

- (1) Exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

Code 3-Doors

- (1) Interior personnel doors or hardware not functioning properly.

Code 1-Electrical

- (1) Power failure (entire area or any building operational after 1600 hours).
- (2) Security lights
- (3) Smoke detectors

Code 2-Electrical

- (1) Power failure (no power to a room or part of building).
- (2) Receptacle and lights (in a room or part of building).

Code 1-Gas

- (1) Leaks and breaks.
- (2) No gas to family housing unit or cantonment area.

Code 1-Heat

- (1). Area power failure affecting heat.
- (2). Heater in unit not working.

Code 2-Kitchen Equipment

- (1) Dishwasher not operating properly.
- (2) All other equipment hampering preparation of a meal.

Code 1-Plumbing

- (1) Hot water heater failure.
- (2) Leaking water supply pipes.

Code 2-Plumbing

- (1) Flush valves not operating properly.
- (2) Fixture drain, supply line to commode, or any water pipe leaking.
- (3) Commode leaking at base.

Code 3 -Plumbing

Leaky faucets.

Code 3-Interior

- (1) Floors damaged.

- (2) Paint chipping or peeling.
- (3) Casework.

Code 1-Roof Leaks

Temporary repairs will be made where major damage to property is occurring.

Code 2-Roof Leaks

Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 2-Water (Exterior)

No water to facility.

Code 2-Water (Hot)

No hot water in portion of building listed.

Code 3-All other work not listed above.

1.3.5 Warranty Tags

At the time of installation, each warranted item shall be tagged with a durable, oil and water resistant tag approved by the Contracting Officer. Each tag shall be attached with a copper wire and shall be sprayed with a silicone waterproof coating. The date of acceptance and the QC signature shall remain blank until project is accepted for beneficial occupancy. The tag shall show the following information.

- a. Type of product/material_____.
- b. Model number_____.
- c. Serial number_____.
- d. Contract number_____.
- e. Warranty period_____from_____to_____.
- f. Inspector's signature_____.
- g. Construction Contractor_____.
- Address_____.
- Telephone number_____.
- h. Warranty contact_____.
- Address_____.
- Telephone number_____.
- i. Warranty response time priority code_____.

j. WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.

1.4 MECHANICAL TESTING, ADJUSTING, BALANCING, AND COMMISSIONING

Prior to final inspection and transfer of the completed facility; all reports, statements, certificates, and completed checklists for testing, adjusting, balancing, and commissioning of mechanical systems shall be submitted to and approved by the Contracting Officer as specified in applicable technical specification sections.

1.5 OPERATION AND MAINTENANCE MANUALS

Operation manuals and maintenance manuals shall be submitted as specified. Operation manuals and maintenance manuals provided in a common volume shall be clearly differentiated and shall be separately indexed.

1.6 FINAL CLEANING

The premises shall be left broom clean. Stains, foreign substances, and temporary labels shall be removed from surfaces. Carpet and soft surfaces shall be vacuumed. Equipment and fixtures shall be cleaned to a sanitary condition. Filters of operating equipment shall be replaced. Debris shall be removed from roofs, drainage systems, gutters, and downspouts. Paved areas shall be swept and landscaped areas shall be raked clean. The site shall have waste, surplus materials, and rubbish removed. The project area shall have temporary structures, barricades, project signs, and construction facilities removed. A list of completed clean-up items shall be submitted on the day of final inspection.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

SECTION 01850

CONTRACTOR WARRANTY MANAGEMENT
NYD Edition 4/03

PART 1 GENERAL

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

Warranty of Construction. Per ref 1.a all construction shall be warranted against defects for a one-year period beginning at the project acceptance point. In addition, there may equipment, systems or items for which labor and/or materials are warranted beyond the one year point. These are extended warranty items. In order to insure that the Government systematically receives all warranties of construction, equipment and systems to which it is entitled, the contractor shall execute all actions as required by above references and as contained herein. The contractor shall not be permitted to claim improper and/or lack of maintenance as a reason to abdicate its responsibility to correct a warranty or latent defect items if the contractor is not in contract compliance pursuant to submission of O&M Manuals and /or maintenance instructions as required by references indicated in paragraph 4. or elsewhere in this contract.

3.2 TAGGING OF EXTENDED WARRANTY ITEMS

The Contractor shall install tags to identify items protected by extended warranty. The tags shall be minimum 3 inches by 5 inches in size, machine-printed in minimum 14-point type, and shall be weatherproof and oil resistant. Tags shall be attached to equipment if accessible or to accessible control panel, etc. As a minimum, tags shall indicate the following information:

"Extended Warranty Item:"
Name of Item
Name of System with which associated, number designation within system, or other identifier
Model Number
Serial Number
Start and end Dates of Warranty
Contract number
Contract Name
Contractor Name
Warranty Point of Contact name, organization and telephone number.
Warranty response time priority code
"WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD."

Contractor shall install additional tags on all equipment and systems where required for reasons of safety, maintenance, and prevention of damage.

3.3 POSTING OF INSTRUCTIONS

In addition to any posting of operating procedures as may be required elsewhere in this contract, any equipment or system for which proper operation or maintenance is critical in order to preserve warranties, prevent damage, or for reasons of safety shall have proper operating procedures and a Summarized Schedule of Maintenance Instructions posted near the equipment, system or near the operating point. The summarized schedule of Maintenance Instructions shall be inclusive and specific regarding all system components, indicate frequency of maintenance for each maintenance item, and briefly describe each maintenance procedure and cross-reference the volume and page number of the O&M Manual that details the maintenance procedure. Training shall include review of the Summarized Schedule of Maintenance Instructions and O&M Manual cross-references. Instructions shall be protected by 1/16 inch thick plastic sheet. As a minimum such equipment or system shall include:

Electrical Substations

Transformers

Electrical Generators

Major HVAC System components including chillers, air-handlers, fans, etc.

HVAC Control Panel

Boilers

Air Compressors

3.4 WARRANTY PLAN

Within 10 days of the 80% completion point of this contract (or deliverable phase thereof), the contractor shall submit a warranty plan for Government approval per section "Submittals". The Warranty Plan shall include all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan shall be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The plan shall be signed by a principal of the contractor. All documents in the plan shall be assembled in a binder. Upon acceptance it shall be signed by a Government Representative. The term "status" as indicated below shall include due date and whether item has been submitted or was accomplished. As a minimum the plan shall indicate:

a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the contractor's, subcontractors or suppliers involved. This shall cover both the one year warranty of construction and extended warranty items or systems.

b. Listing and status of O&M manuals and As-built drawings, and expected delivery dates.

c. Listing and status of all training to be provided to Government personnel, whether specified by contract or required by manufacturers.

Indicate dates of training both planned and accomplished.

d. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.

e. A spreadsheet-type list for each warranted equipment, item, feature of construction or system, to include roofs, HVAC components, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc., as applicable. For each item, the list shall indicate the following information:

- Name of item
- Model and serial numbers.
- Location where installed
- Names of manufacturers or, suppliers and phone numbers.
- Names addresses and telephone numbers of sources of spare parts
- Identification of Warranted materials and labor, and other terms warranty.
- Cross-reference to warranty certificates as applicable.
- Starting point and duration of warranty period.
- Summary of maintenance procedures required to continue the warranty in force.
- Cross-reference to specific pertinent Operation and Maintenance manuals
- Organization, names and phone numbers of persons to call for warranty service
- Typical response time and repair time expected for various warranted equipment

f. List of spare parts supplied and/or recommended by manufacturer for each piece of equipment.

g. The contractor's acknowledgement of intention to attend the Four and Nine month post-construction warranty inspections conducted by the Government.

h. Status of tagging of all equipment covered by extended warranties.

i. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons

j. Contractor's understandings with respect to warranty responsibilities for the one year overall warranty of construction, and expected performance on warranty calls during this period.

3.5 WARRANTY MEETING

Within 10 days after the approval of the Warranty Plan the contractor will notify the Government representative for the purpose of scheduling a meeting to clarify understandings of responsibilities with respect to warranties to which the Government is entitled. The Government and

contractor shall attend the warranty meeting, as well as any subcontractors, or suppliers involved in the warranty process. The Warranty Plan shall be the basis of the meeting's agenda. Contractor will prepare minutes of the meeting indicating major understandings reached, and submit for Government approval within 3 days of the meeting. Minutes will be signed by authorized representatives of the Contractor and Government.

3.6 WARRANTY REQUIREMENTS COMPLIANCE

Expected performance of the Contractor on warranty work is indicated herein. If Contractor performance on a warranty call is unsatisfactory, the Contracting Officer may authorize the use of funds remaining in the contract to accomplish the warranty work on an expedited basis including the cost of Government administrative expenses. Repeated poor performance may result in retaining any payment due the Contractor until after the warranty of construction period. The Contractor's Performance Bond shall remain effective through the contract-specified warranty period. Poor warranty performance may also result in a poor contractor performance rating being entered into the Government CCASS system, or downward revision of such rating if already entered.

3.7 WARRANTY PERFORMANCE

Expected Response to Construction Warranty Service Requests and Completion of Repairs: Following oral or written notification by the Contracting Officer, the Contractor shall respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. The Contractor shall submit a report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed.

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

d. The "Construction Warranty Service Priority List" is as follows:

Code 1-Air Conditioning Systems

- (1) Recreational support.
- (2) Air conditioning leak in part of building, if causing damage.
- (3) Air conditioning system not cooling properly.

Code 1-Doors

- (1) Overhead doors not operational, causing a security, fire, or safety problem.

(2) Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

Code 3-Doors

- (1) Overhead doors not operational.
- (2) Interior/exterior personnel doors or hardware not functioning properly.

Code 1-Electrical

- (1) Power failure (entire area or any building operational after 1600 hours).
- (2) Security lights
- (3) Smoke detectors

Code 2-Electrical

- (1) Power failure (no power to a room or part of building).
- (2) Receptacle and lights (in a room or part of building).

Code 3-Electrical

Street lights.

Code 1-Gas

- (1) Leaks and breaks.
- (2) No gas to family housing unit or cantonment area.

Code 1-Heat

- (1). Area power failure affecting heat.
- (2). Heater in unit not working.

Code 2-Kitchen Equipment

- (1) Dishwasher not operating properly.
- (2) All other equipment hampering preparation of a meal.

Code 1-Plumbing

- (1) Hot water heater failure.
- (2) Leaking water supply pipes.

Code 2-Plumbing

- (1) Flush valves not operating properly.
- (2) Fixture drain, supply line to commode, or any water pipe leaking.
- (3) Commode leaking at base.

Code 3 -Plumbing

Leaky faucets.

Code 3-Interior

- (1) Floors damaged.
- (2) Paint chipping or peeling.
- (3) Casework.

Code 1-Roof Leaks

Temporary repairs will be made where major damage to property is occurring.

Code 2-Roof Leaks

Where major damage to property is not occurring, check for location of leak

during rain and complete repairs on a Code 2 basis.

Code 2-Water (Exterior)
No water to facility.

Code 2-Water (Hot)
No hot water in portion of building listed.

Code 3-All other work not listed above.

3.8 POST-COMPLETION INSPECTIONS

The Government conducts project inspections for purposes identifying warranted deficiencies at the four and nine month points after project acceptance. The Contractor is required to attend these inspections in order to better manage any warranty items for which it may be responsible.

-- End of Section --

SECTION 02217A

FOUNDATION PREPARATION

09/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI 506.2 (1995) Specification for Shotcrete

ASTM INTERNATIONAL (ASTM)

ASTM A 185 (2002) Steel Welded Wire Reinforcement,
Plain, for Concrete

ASTM C 270 (2003) Mortar for Unit Masonry

ASTM C 387 (2000e1) Packaged, Dry, Combined Materials
for Mortar and Concrete

1.2 UNIT PRICES

1.2.1 Preliminary Cleanup

1.2.1.1 Payment

Payment will be made for costs for each preliminary cleanup satisfactorily performed at the direction of the Contracting Officer. Payment will be made for each cleanup of the same area if more than one cleanup has been directed and satisfactorily performed.

1.2.1.2 Measurement

Preliminary cleanup will be measured for payment by determining the area cleaned to the nearest square meter .

1.2.1.3 Unit of Measure

Unit of measure: square meter .

1.2.2 Final Cleanup

1.2.2.1 Payment

Payment will be made for costs associated with final cleanup of the area

for each type of foundation preparation that has been satisfactorily prepared. Where preliminary cleanup has been directed and performed and the contractor subsequently performs final cleanup, payment will be made for preliminary cleanup. Payment will not be made for any cleanup subsequent to final cleanup.

1.2.2.2 Measurement

Final cleanup will be measured for payment by determining the area cleaned to the nearest square meter .

1.2.2.3 Unit of measure

Square meter .

1.2.3 Foundation Preparation

1.2.3.1 Payment

Payment will be made for costs associated with foundation preparation of the area for each type of foundation preparation that has been satisfactorily prepared. Where preliminary cleanup has been directed and performed and the contractor subsequently performs foundation preparation, payment will be made for foundation preparation. Payment will not be made for more than one foundation preparation of the same area.

1.2.3.2 Measurement

Foundation preparation will be measured for payment by determining the area prepared to the nearest square meter .

1.2.3.3 Unit of measure

Square meter .

1.2.4 Dental Concrete

1.2.4.1 Payment

Payment will be made for costs associated with dental concrete placed.

1.2.4.2 Measurement

Dental concrete will be measured for payment by determining the volume to the nearest one-tenth cubic meter .

1.2.4.3 Unit of measure

Cubic meter .

1.2.5 Dental Mortar

1.2.5.1 Payment

Payment will be made for costs associated with dental mortar placed.

1.2.5.2 Measurement

Dental mortar will be measured for payment by determining the volume to the nearest one-tenth cubic meter .

1.2.5.3 Unit of measure

Cubic meter .

1.3 DEFINITIONS

1.3.1 Foundations

The rock foundation is comprised of the rock surfaces upon which embankment and concrete structures are placed. Vertical surfaces, where permitted or required by these specifications, are included.

1.3.2 Rock Joints

Rock joints are all planar and/or curvilinear fractures, including cracks, crevices, and seams which separate a rock mass into individual rock blocks of various sizes. They may be open or closed and may be filled with material other than rock material.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Tools

Tabular list of light power tools to be used in lieu of hand tools shall be submitted for approval prior to their use on the job site.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Dental Concrete

Dental concrete shall conform to the requirements of Section 03307.

2.1.2 Dental Mortar

Dental mortar shall conform with ASTM C 270 or ASTM C 387, Type N.

2.1.3 Shotcrete

Shotcrete shall conform to the requirements of ACI 506.2. The compressive strength of the concrete shall be 27.6 MPa.

2.1.4 Welded Wire Fabric

Welded wire fabric used shall be 150 by 150 mm - W3 x W3, conforming to ASTM A 185.

2.1.5 Non Frost Susceptible (NFS) Material

NFS material shall consist of sand and gravel and shall meet the applicable requirements of Section 02300 EARTHWORK. The NFS material shall be composed of tough, durable particles, reasonably free from thin, flat and elongated pieces, and shall contain no organic matter nor soft, friable particles in quantities considered objectionable by the Contracting Officer. Grading shall conform to the following requirements:

U.S. STANDARD SIEVE	PERMISSIBLE LIMITS PERCENT BY WEIGHT, PASSING
3 inch	100
3/4 inch	50-100
#4	25-60
#10	15-50
#40	4-30
#200	2-6

* In addition to the grading limits listed above, the fraction of material passing the #200 sieve shall not be greater than 20 percent of that fraction passing the #4 sieve.

The NFS materials shall be well-graded between the limits shown. At least one test shall be performed on each 1000 tons (metric) to be delivered to the project site for each gradation band. All points on individual grading curves obtained from representative samples of NFS material shall lie between the boundary limits as defined by smooth curves drawn through the tabulated grading limits plotted on a mechanical analysis diagram. The individual grading curves within these limits shall not exhibit abrupt changes in slope denoting either skip grading or scalping of certain sizes or other irregularities which would be detrimental to the proper functioning of the material.

PART 3 EXECUTION

3.1 EXAMINATION

The limits of the proposed foundations for the various parts of the work

are approximately as indicated. The Contracting Officer reserves the right to change the depth to, or the width of, the foundations if, conditions exposed in the foundation excavations, or as determined by exploratory drilling, warrant such modifications.

3.2 PREPARATION

3.2.1 Equipment

3.2.1.1 Tools

Hand tools, where required or permitted by these specifications include, but are not limited to shovels, bars, picks, wedges, and brooms. Light power tools may be used in lieu of hand tools only when such use is approved.

3.3 PRELIMINARY CLEANUP

When the excavation has reached the approximate limits shown or when the Contracting Officer determines that a satisfactory foundation may have been reached, the Contracting Officer may direct that a preliminary cleanup be performed on all or any part of the rock foundation surface. This cleanup shall consist of removing all debris, loose rock, sand, silt, and other objectionable material by hand tools followed by air/water jets or any combination of additional methods approved or directed. The Contracting Officer may require that the excavation be continued and the preliminary cleanup procedure repeated until a satisfactory foundation surface is reached.

3.4 FINAL CLEANUP AND FOUNDATION PREPARATION

Unless otherwise directed, Final Cleanup and Foundation Preparation, shall be performed prior to erection of building frame. This work shall consist of removing loose and/or weather rock and pockets of fines, sand, rock rubble or gravel and other objectionable material from the in place rock surface including areas of depression, large crevices, and open rock joints. Picking, barring, and hand excavation may be necessary to obtain a foundation surface free from loose, drummy, or shattered materials.

3.5 PROTECTIVE TREATMENT

Protective treatment shall be as specified in the drawings.

3.5.1 Wetting

The area shall be kept wet by continuous spraying or by other approved method. The Contractor shall provide positive measures to control the runoff.

3.5.2 Protective Backfill

The final 600 mm of excavation, final cleanup and foundation preparation, inspection, and placement of the first 300 mm of backfill shall all be accomplished within a period of 8 hours. Within 48 hours after the start

of the final excavation, the backfill shall have a minimum thickness of 1000 mm . The backfill shall be placed in accordance with the requirements of Section 02300.

3.5.3 Temporary Earth Cover

Within 8 hours of excavation, and Before freezing weather is expected, the area will be protected by a temporary earth cover 300 mm thick. The material shall be removed and the area cleaned, inspected, and prepared prior to placement of concrete thereon.

3.6 TESTS

3.6.1 General

The Contractor shall establish and maintain quality control for foundation preparation operations to assure compliance with contract specifications and shall maintain records of his quality control for all operations including but not limited to the following:

3.6.1.1 Equipment

Quantity and type.

3.6.1.2 Foundation Excavation

Strict adherence to foundation excavation limits and depths.

3.6.1.3 Inspection, Mapping, and Cleanup

Orderly prosecution of inspections, mapping, and cleanup of foundation excavation areas.

3.6.2 Reports

Three copies of these records of inspection as well as corrective action taken shall be submitted daily.

3.7 FOUNDATION INSPECTION AND GEOLOGIC MAPPING

Inspections to determine adequacy of the foundations will be performed by the Contracting Officer in all foundation areas between completion of excavation and placement of embankment, or concrete, or protective treatment.

The Contractor will cooperate to the extent necessary to assist in inspection and mapping activities which may require additional survey control points and access. The Contractor will coordinate his schedule for foundation excavation and preliminary cleanup with the Contracting Officer to insure that the cleanup, inspection, and mapping proceed in an orderly manner.

-- End of Section --

SECTION 02220

DEMOLITION
09/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI Guideline K (1997) Containers for Recovered
Fluorocarbon Refrigerants

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.6 (1990; R 1998) Safety Requirements for
Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (1996) Safety and Health Requirements
Manual

U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA 4145.25 (June 2000) Storage and Handling of
Liquefied and Gaseous Compressed Gases and
Their Full and Empty Cylinders

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 4000.25-1-M Requisitioning and Issue Procedures

MIL-STD-129 (Rev. P) Military Marking for Shipment and
Storage

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61-SUBPART M National Emission Standard for Asbestos

40 CFR 82 Protection of Stratospheric Ozone

49 CFR 173.301 Shipment of Compressed Gases in Cylinders
and Spherical Pressure Vessels

1.2 GENERAL REQUIREMENTS

Do not begin demolition until authorization is received from the Contracting Officer. Remove rubbish and debris from the project site; do not allow accumulations inside or outside the building. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of occupational safety and health, the work shall be performed in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections. In the interest of conservation, salvage shall be pursued to the maximum extent possible (in accordance with Section 01572 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT, if applicable; salvaged items and materials shall be disposed of as specified.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Demolition plan; C-101

Submit proposed salvage, demolition and removal procedures to the Contracting Officer for approval before work is started.

SD-11 Closeout Submittals

Receipts

Receipts or bills of lading, as specified.

1.4 REGULATORY AND SAFETY REQUIREMENTS

Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," safety requirements shall conform with ANSI A10.6.

1.4.1 Notifications

1.4.1.1 General Requirements

Furnish timely notification of demolition projects to Federal and local authorities in accordance with 40 CFR 61-SUBPART M. Notify the local air pollution control district/agency and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR

61-SUBPART M.

1.4.2 Receipts

Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped to the Defense Depot, Richmond, Virginia.

1.5 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris to occupied portions of the building and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

1.6 PROTECTION

1.6.1 Traffic Control Signs

Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the Contracting Officer prior to beginning such work.

1.6.2 Existing Work

Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal work. Repairs, reinforcement, or structural replacement must have Contracting Officer approval.

1.6.3 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, shall remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Contracting Officer. The Contractor shall ensure that no elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work.

performed under this contract.

1.6.4 Protection of Personnel

During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.7 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.8 FOREIGN OBJECT DAMAGE (FOD)

Aircraft and aircraft engines are subject to FOD from debris and waste material lying on airfield pavements. Remove all such materials that may appear on operational aircraft pavements due to the Contractor's operations. If necessary, the Contracting Officer may require the Contractor to install a temporary barricade at the Contractor's expense to control the spread of FOD potential debris. The barricade shall consist of a fence covered with a fabric designed to stop the spread of debris; anchor the fence and fabric to prevent displacement by winds or jet/prop blasts. Remove barricade when no longer required.

1.9 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by the Contracting Officer.

1.10 REQUIRED DATA

Demolition plan shall include procedures for careful removal and disposition of materials specified to be salvaged. The procedures shall provide for safe conduct of the work in accordance with EM 385-1-1.

1.11 ENVIRONMENTAL PROTECTION

The work shall comply with the requirements of Section 01355A ENVIRONMENTAL PROTECTION.

1.12 USE OF EXPLOSIVES

Use of explosives will not be permitted.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

3.1.1 Structures

Existing structures indicated shall be removed to grade. Interior walls, other than retaining walls and partitions, shall be removed to 2 meters below grade. Basement slabs shall be broken up to permit drainage. Sidewalks, curbs, gutters and street light bases shall be removed as indicated.

3.1.2 Utilities and Related Equipment

Remove existing utilities, as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area. Remove meters and related equipment and deliver to a location in accordance with instructions of the Contracting Officer. If utility lines are encountered that are not shown on drawings, contact the Contracting Officer for further instructions.

3.1.3 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated, and shall include:

- a. Holes and depressions caused by previous physical damage or left as a result of removals in existing masonry walls to remain shall be completely filled with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.
- b. Where existing partitions have been removed leaving damaged or missing resilient tile flooring, patch to match the existing floor tile.
- c. Patch acoustic lay-in ceiling where partitions have been removed. The transition between the different ceiling heights shall be effected by continuing the higher ceiling level over to the first runner on the lower ceiling and closing the vertical opening with a painted sheet metal strip.

3.1.4 Cylinders and Canisters

Remove all fire suppression system cylinders and canisters and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting

Substance (ODS)."

3.1.5 Locksets on Swinging Doors

The Contractor shall remove all locksets from all swinging doors indicated to be removed and disposed of. Contractor shall give the locksets to the Contracting Officer after their removal.

3.2 FILLING

Holes, open basements and other hazardous openings shall be filled in accordance with Section 02217.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except where specified in other sections, all materials and equipment removed, and not reused, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition and removal procedures, and authorization by the Contracting Officer to begin demolition. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award.

Materials and equipment shall not be viewed by prospective purchasers or sold on the site.

3.3.2 Disposal of Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in Section, 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting ARI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. Recovered ODS shall be removed from Government property and disposed of in accordance with 40 CFR 82. Products, equipment and appliances containing ODS in a sealed, self-contained system (e.g. residential refrigerators and window air conditioners) shall be disposed of in accordance with 40 CFR 82.

3.3.2.1 Special Instructions

Each container shall have in it no more than one type of ODS. A warning/hazardous label shall be applied to the containers in accordance with Department of Transportation regulations. All cylinders including but not limited to fire extinguishers, spheres, or canisters containing an ODS shall have a tag with the following information:

- a. Activity name and unit identification code
- b. Activity point of contact and phone number
- c. Type of ODS and pounds of ODS contained

d. Date of shipment

e. Naval stock number (for information, call (804) 279-4525).

3.3.2.2 Fire Suppression Containers

Fire suppression system cylinders and canisters with electrical charges or initiators shall be deactivated prior to shipment. Also, safety caps shall be used to cover exposed actuation mechanisms and discharge ports on these special cylinders.

3.3.3 Transportation Guidance

Shipment of all ODS containers shall be in accordance with MIL-STD-129, DLA 4145.25 (also referenced one of the following: Army Regulation 700-68, Naval Supply Instruction 4440.128C, Marine Corps Order 10330.2C, and Air Force Regulation 67-12), 49 CFR 173.301, and DOD 4000.25-1-M.

3.3.4 Unsalvageable Material

Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed of in the disposal area located as directed by the Contracting Officer. The fill in the disposal area shall remain below elevation as required to maintain site drainage and after disposal is completed, the disposal area shall be uniformly graded to drain. Combustible material shall be disposed of off the site.

3.4 CLEANUP

Debris and rubbish shall be removed from basement and similar excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

3.4.1 Debris and Rubbish

Debris and rubbish shall be removed from basement and similar excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

-- End of Section --

SECTION 02300

EARTHWORK

08/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO T 180 (2001) Moisture-Density Relations of Soils
Using a 4.54-kg (10-lb) Rammer and an
457-mm (18-in) Drop

AASHTO T 224 (2001) Correction for Coarse Particles in
the Soil Compaction Test

ASTM INTERNATIONAL (ASTM)

ASTM C 136 (2001) Sieve Analysis of Fine and Coarse
Aggregates

ASTM D 1140 (2000) Amount of Material in Soils Finer
than the No. 200 (75-micrometer) Sieve

ASTM D 1556 (2000) Density and Unit Weight of Soil in
Place by the Sand-Cone Method

ASTM D 1557 (2002) Laboratory Compaction
Characteristics of Soil Using Modified
Effort (56,000 ft-lbf/cu. ft. (2,700
kN-m/cu.m.))

ASTM D 2434 (1968; R 2000) Permeability of Granular
Soils (Constant Head)

ASTM D 2487 (2000) Soils for Engineering Purposes
(Unified Soil Classification System)

ASTM D 2922 (2001) Density of Soil and Soil-Aggregate
in Place by Nuclear Methods (Shallow Depth)

ASTM D 422 (1963; R 2002) Particle-Size Analysis of
Soils

ASTM D 4318 (2000) Liquid Limit, Plastic Limit, and

Plasticity Index of Soils

ASTM D 698

(2000a) Laboratory Compaction
Characteristics of Soil Using Standard
Effort (12,400 ft-lbf/cu. ft. (600
kN-m/cu. m.))

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 530/F-93/004

(1993; Rev O; Updates I, II, IIA, IIB, and
III) Test Methods for Evaluating Solid
Waste (Vol IA, IB, IC, and II) (SW-846)

EPA 600/4-79/020

(1983) Methods for Chemical Analysis of
Water and Wastes

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC, CL, ML, CL-ML, CH, MH. Satisfactory materials for grading shall be comprised of stones less than 200 mm , except for fill material for pavements which shall be comprised of stones less than 75 mm in any dimension.

1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. The Contracting Officer shall be notified of any contaminated materials.

1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Testing required for classifying materials shall be in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

1.2.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density. Since ASTM D 1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 9.0 mm sieve, the degree of compaction for material having more than 30 percent by weight

of their particles retained on the 9.0 mm sieve shall be expressed as a percentage of the maximum density in accordance with AASHTO T 180 Method D and corrected with AASHTO T 224. To maintain the same percentage of coarse material, the "remove and replace" procedure as described in the NOTE 8 in Paragraph 7.2 of AASHTO T 180 shall be used.

1.2.5 Hard/Unyielding Materials

Weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than 75 mm in any dimension. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.2.6 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 0.375 cubic meter in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.2.7 Unstable Material

Unstable material shall consist of materials too wet to properly support the appurtenant structure.

1.2.8 Select Granular Material

1.2.8.1 General Requirements

Select granular material shall consist of materials classified as GW by ASTM D 2487 where indicated. The liquid limit of such material shall not exceed 35 percent when tested in accordance with ASTM D 4318. The plasticity index shall not be greater than 12 percent when tested in accordance with ASTM D 4318, and not more than 35 percent by weight shall be finer than 75 micrometers sieve when tested in accordance with ASTM D 1140. Coefficient of permeability shall be a minimum of 0.01 mm per second when tested in accordance with ASTM D 2434.

1.2.9 Nonfrost Susceptible (NFS) Material

Nonfrost susceptible material shall be a uniformly graded washed sand with a maximum particle size of 2 mm and less than 5 percent passing the 0.075 mm size sieve, and with not more than 3 percent by weight finer than 0.02 mm grain size.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as

otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Submit 15 days prior to starting work.

SD-03 Product Data

Utilization of Excavated Materials
Rock Excavation
Opening of any Excavation or Borrow Pit

Procedure and location for disposal of unused satisfactory material. Proposed source of borrow material. Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

SD-06 Test Reports

Testing
Borrow Site Testing

Within 24 hours of conclusion of physical tests, 2 copies of test results, including calibration curves and results of calibration tests. Results of testing at the borrow site.

SD-07 Certificates

Testing

Qualifications of the commercial testing laboratory or Contractor's testing facilities.

1.4 SUBSURFACE DATA

Subsurface soil boring logs are included on the contract plans. The subsoil investigation report and samples of materials taken from subsurface investigations may be examined at Michael Baker Jr., Inc. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.5 CLASSIFICATION OF EXCAVATION

Excavation specified shall be done on a classified basis, in accordance with the following designations and classifications.

1.5.1 Common Excavation

Common excavation shall include the satisfactory removal and disposal of all materials not classified as rock excavation.

1.5.2 Rock Excavation

Rock excavation shall include blasting, excavating, grading, and disposing of material classified as rock and shall include the satisfactory removal and disposal of boulders 1/2 cubic meter or more in volume; solid rock; rock material that is in ledges, bedded deposits, and unstratified masses, which cannot be removed without systematic drilling and blasting; firmly cemented conglomerate deposits possessing the characteristics of solid rock impossible to remove without systematic drilling and blasting; and hard materials (see Definitions). The removal of any concrete or masonry structures, except pavements, exceeding 1/2 cubic meter in volume that may be encountered in the work shall be included in this classification. If at any time during excavation, including excavation from borrow areas, the Contractor encounters material that may be classified as rock excavation, such material shall be uncovered and the Contracting Officer notified by the Contractor. The Contractor shall not proceed with the excavation of this material until the Contracting Officer has classified the materials as common excavation or rock excavation and has taken cross sections as required. Failure on the part of the Contractor to uncover such material, notify the Contracting Officer, and allow ample time for classification and cross sectioning of the undisturbed surface of such material will cause the forfeiture of the Contractor's right of claim to any classification or volume of material to be paid for other than that allowed by the Contracting Officer for the areas of work in which such deposits occur.

1.6 CRITERIA FOR BIDDING

Base bids on the following criteria:

- a. Surface elevations are as indicated.
- b. Pipes or other artificial obstructions, except those indicated, will not be encountered.
- c. Material character is indicated by the boring logs.

1.7 DEWATERING WORK PLAN

Submit procedures for accomplishing dewatering work.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR OFFSITE SOILS

Offsite soils brought in for use as backfill shall be tested for TPH, BTEX and full TCLP including ignitability, corrosivity and reactivity. Backfill shall contain less than 100 parts per million (ppm) of total petroleum hydrocarbons (TPH) and less than 10 ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and shall not fail the TCPL test. TPH concentrations shall be determined by using EPA 600/4-79/020 Method 418.1. BTEX concentrations shall be determined by using EPA 530/F-93/004 Method 5030/8020. TCLP shall be performed in accordance with EPA 530/F-93/004 Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a

composite sample of material from the borrow site, with at least one test from each borrow site. Material shall not be brought on site until tests have been approved by the Contracting Officer.

PART 3 EXECUTION

3.1 GENERAL EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Such excavated material and the satisfactory material ordered as replacement shall be included in excavation. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of in areas approved for surplus material storage or designated waste areas. Unsatisfactory excavated material shall be disposed of in designated waste or spoil areas.

During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.1.1 Ditches, Gutters, and Channel Changes

Excavation of ditches, gutters, and channel changes shall be accomplished by cutting accurately to the cross sections, grades, and elevations shown. Ditches and gutters shall not be excavated below grades shown. Excessive open ditch or gutter excavation shall be backfilled with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Material excavated shall be disposed of as shown or as directed, except that in no case shall material be deposited less than 1 meter from the edge of a ditch. The Contractor shall maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.1.2 Drainage Structures

Excavations shall be made to the lines, grades, and elevations shown, or as directed. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm, level, stepped, or serrated surface. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, the bottom of the excavation shall not be disturbed. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed. Where pile foundations are to be used, the excavation of each pit shall be stopped at an elevation 300 mm above the

base of the footing, as specified, before piles are driven. After the pile driving has been completed, loose and displaced material shall be removed and excavation completed, leaving a smooth, solid, undisturbed surface to receive the concrete or masonry.

3.1.3 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish/construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.1.4 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 0.9 m of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously. Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly.

3.1.5 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Excavate to bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the Contracting Officer. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of ASTM D 698 maximum density.

3.2 SELECTION OF BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas shown on drawings. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including

rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

3.3 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

The Contractor shall notify the Contracting Officer sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.4 SHORING

3.4.1 General Requirements

The Contractor shall submit a Shoring and Sheet piling plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheet piling of excavations. Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheet piling shall be removed as excavations are backfilled, in a manner to prevent caving.

3.4.2 Geotechnical Engineer

The Contractor is required to hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer shall be responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer shall update the excavation, sheet piling and dewatering plans as construction progresses to reflect changing conditions and shall submit an updated plan if necessary. A written report shall be submitted, at least monthly, informing the Contractor and Contracting Officer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Geotechnical Engineer shall be available to meet with the Contracting Officer at any time throughout the contract duration.

3.5 GRADING AREAS

Where indicated, work will be divided into grading areas within which satisfactory excavated material shall be placed in embankments, fills, and required backfills. The Contractor shall not haul satisfactory material

excavated in one grading area to another grading area except when so directed in writing. Stockpiles of satisfactory and wasted materials shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources.

3.6 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed. Only excavation methods that will leave the foundation rock in a solid and unshattered condition shall be used. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. Shales shall be protected from slaking and all surfaces shall be protected from erosion resulting from ponding or flow of water.

3.7 GROUND SURFACE PREPARATION

3.7.1 General Requirements

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 150 mm before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 150 mm, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 300 mm and compacted as specified for the adjacent fill.

3.7.2 Frozen Material

Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to plus or minus 1 percent of optimum moisture. Minimum subgrade density shall be as specified in paragraph TESTING.

3.8 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of in designated waste disposal or spoil areas. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for

similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in designated areas approved for surplus material storage or designated waste areas as directed. Newly designated waste areas on Government-controlled land shall be cleared and grubbed before disposal of waste material thereon. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.9 BACKFILLING AND COMPACTION

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION SUBGRADE. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR EMBANKMENTS, EMBANKMENTS, and SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.10 EMBANKMENTS

3.10.1 Earth Embankments

Earth embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 75 mm.

The material shall be placed in successive horizontal layers of loose material not more than 6 mm in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements shall be identical with those requirements specified in paragraph SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.11 SUBGRADE PREPARATION

3.11.1 Construction

Subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any

moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 150 mm below finished grade for the subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified. After rolling, the surface of the subgrade for roadways shall not show deviations greater than 1 mm when tested with a 3 meter straightedge applied both parallel and at right angles to the centerline of the area.

3.11.2 Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.12 SHOULDER CONSTRUCTION

Shoulders shall be constructed of satisfactory excavated or borrow material or as otherwise shown or specified. Shoulders shall be constructed as soon as possible after adjacent paving is complete, but in the case of rigid pavements, shoulders shall not be constructed until permission of the Contracting Officer has been obtained. The entire shoulder area shall be compacted to at least the percentage of maximum density as specified in paragraph SUBGRADE PREPARATION above, for specific ranges of depth below the surface of the shoulder. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Shoulder construction shall be done in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. The completed shoulders shall be true to alignment and grade and shaped to drain in conformity with the cross section shown.

3.13 FINISHING

The surface of excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 30 mm of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in paragraph SUBGRADE PREPARATION. Gutters and ditches shall be finished in a manner that will result in effective drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials.

Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work, shall be repaired and grades re-established to the required elevations and slopes.

3.13.1 Subgrade and Embankments

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained to drain

effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No subbase, base course, ballast, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing, pavement, or ballast be placed on a muddy, spongy, or frozen subgrade.

3.13.2 Grading Around Structures

Areas within 1.5 m outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

3.14 TESTING

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. Field in-place density shall be determined in accordance with ASTM D 1556. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompact to meet specification requirements. Tests on recompact areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests.

The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.14.1 Fill and Backfill Material Gradation

One test per 250 cubic meters stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C 136.

3.14.2 In-Place Densities

- a. One test per 100 square meters, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.
- b. One test per 50 square meters, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.
- c. One test per 50 linear meters, or fraction thereof, of each lift of embankment or backfill for roads.

3.14.3 Check Tests on In-Place Densities

If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows:

- a. One check test per lift for each 100 square meters, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.
- b. One check test per lift for each 50 square meters, of fill or backfill areas compacted by hand-operated machines.
- c. One check test per lift for each 50 linear meters, or fraction thereof, of embankment or backfill for roads.

3.14.4 Moisture Contents

In the stockpile, excavation, or borrow areas, a minimum of two tests per day per type of material or source of material being placed during stable weather conditions shall be performed. During unstable weather, tests shall be made as dictated by local conditions and approved by the Contracting Officer.

3.14.5 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 100 cubic meters of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.14.6 Tolerance Tests for Subgrades

Continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION shall be made during construction of the subgrades.

3.15 DISPOSITION OF SURPLUS MATERIAL

Surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber shall be removed from Government property as directed by the Contracting Officer.

-- End of Section --

SECTION 02373

GEOTEXTILE
09/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 4354	(1999) Sampling of Geosynthetics for Testing
ASTM D 4355	(2002) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D 4491	(1999a) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(1991; R 1996) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 1996) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(1999a) Determining Apparent Opening Size of a Geotextile
ASTM D 4759	(2002) Determining the Specification Conformance of Geosynthetics
ASTM D 4833	(2000e1) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 4873	(2002) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

1.2 MEASUREMENT

Measurement shall be made of the as-built surface area in square meters covered by geotextile. Allowance will be made for geotextile in anchor and/or drainage trenches but no allowance will be made for waste, overlaps, damaged materials, repairs, or materials used for the convenience of the Contractor.

1.3 PAYMENT

Geotextile installed and accepted will be paid for at the respective contract unit price in the bidding schedule. This unit price shall include the cost of materials, equipment, installation, testing, and other costs associated with placement of the geotextile.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Thread

A minimum of 7 days prior to scheduled use, proposed thread type for sewn seams along with data sheets showing the physical properties of the thread.

Manufacturing Quality Control Sampling and Testing

A minimum of 7 days prior to scheduled use, manufacturer's quality control manual.

SD-04 Samples

Quality Assurance Samples and Tests

Samples for quality assurance testing; 7 days shall be allotted in the schedule to allow for testing.

SD-07 Certificates

Geotextile

A minimum of 7 days prior to scheduled use, manufacturer's certificate of compliance stating that the geotextile meets the requirements of this section. For needle punched geotextiles, the manufacturer shall also certify that the geotextile has been continuously inspected using permanent on-line full-width metal detectors and does not contain any needles which could damage other geosynthetic layers. The certificate of compliance shall be attested to by a person having legal authority to bind the geotextile manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

Delivery, storage, and handling of geotextile shall be in accordance with ASTM D 4873.

1.5.1 Delivery

The Contracting Officer shall be notified a minimum of 24 hours prior to delivery and unloading of geotextile rolls. Rolls shall be packaged in an opaque, waterproof, protective plastic wrapping. The plastic wrapping shall not be removed until deployment. If quality assurance samples are collected, rolls shall be immediately rewrapped with the plastic wrapping. Geotextile or plastic wrapping damaged during storage or handling shall be repaired or replaced, as directed. Each roll shall be labeled with the manufacturer's name, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.

1.5.2 Storage

Rolls of geotextile shall be protected from construction equipment, chemicals, sparks and flames, temperatures in excess of 71 degrees C , or any other environmental condition that may damage the physical properties of the geotextile. To protect geotextile from becoming saturated, rolls shall either be elevated off the ground or placed on a sacrificial sheet of plastic in an area where water will not accumulate.

1.5.3 Handling

Geotextile rolls shall be handled and unloaded with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Rolls shall not be dragged along the ground, lifted by one end, or dropped to the ground.

PART 2 PRODUCTS

2.1 RAW MATERIALS

2.1.1 Geotextile

Geotextile shall be a nonwoven pervious sheet of polymeric material and shall consist of long-chain synthetic polymers composed of at least 95 percent by weight polyolefins, polyesters, or polyamides. The use of woven slit film geotextiles (i.e. geotextiles made from yarns of a flat, tape-like character) will not be allowed. Stabilizers and/or inhibitors shall be added to the base polymer, as needed, to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Regrind material, which consists of edge trimmings and other scraps that have never reached the consumer, may be used to produce the geotextile. Post-consumer recycled material may also be used. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Geotextiles shall meet the requirements specified in Table 1. Where applicable, Table 1 property values represent minimum average roll values (MARV) in the weakest principal direction. Values for AOS represent maximum average roll values.

TABLE 1
MINIMUM PHYSICAL REQUIREMENTS FOR DRAINAGE GEOTEXTILE

TABLE 1
MINIMUM PHYSICAL REQUIREMENTS FOR DRAINAGE GEOTEXTILE

PROPERTY	UNITS	ACCEPTABLE VALUES	TEST METHOD
GRAB STRENGTH	N	315	ASTM D 4632
PUNCTURE	N	120	ASTM D 4833
TRAPEZOID TEAR	N	120	ASTM D 4533
APPARENT OPENING SIZE	U.S. SIEVE	40	ASTM D 4751
PERMITTIVITY	SEC -1	0.55	ASTM D 4491
ULTRAVIOLET DEGRADATION	PERCENT	50 AT 500 HRS	ASTM D 4355

2.1.2 Thread

Sewn seams shall be constructed with high-strength polyester, nylon, or other approved thread type. Thread shall have ultraviolet light stability equivalent to the geotextile and the color shall contrast with the geotextile.

2.2 MANUFACTURING QUALITY CONTROL SAMPLING AND TESTING

The Manufacturer shall be responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request. Manufacturing quality control sampling and testing shall be performed in accordance with the manufacturer's approved quality control manual. As a minimum, geotextiles shall be randomly sampled for testing in accordance with ASTM D 4354, Procedure A. Acceptance of geotextile shall be in accordance with ASTM D 4759. Tests not meeting the specified requirements shall result in the rejection of applicable rolls.

PART 3 EXECUTION

3.1 QUALITY ASSURANCE SAMPLES AND TESTS

3.1.1 Quality Assurance Samples

The Contractor shall provide assistance to the Contracting Officer in the collection of quality assurance samples. Samples shall be collected upon delivery to the site for quality assurance testing in accordance with ASTM D 4354, Procedure B. Lot size for quality assurance sampling shall be considered to be the shipment quantity of the product or a truckload of the product, whichever is smaller. The unit size shall be considered one roll of geotextile. Samples shall be identified with a waterproof marker by manufacturer's name, product identification, lot number, roll number, and machine direction. The date and a unique sample number shall also be noted

on the sample. The outer layer of the geotextile roll shall be discarded prior to sampling a roll. Samples shall then be collected by cutting the full-width of the geotextile sheet a minimum of 1 meter long in the machine direction. Rolls which are sampled shall be immediately resealed in their protective covering.

3.1.2 Quality Assurance Tests

The Contractor shall provide quality assurance samples to an Independent Laboratory. Samples will be tested to verify that geotextile meets the requirements specified in Table 1. Test method ASTM D 4355 shall not be performed on the collected samples. Geotextile product acceptance shall be based on ASTM D 4759. Tests not meeting the specified requirements shall result in the rejection of applicable rolls.

3.2 INSTALLATION

3.2.1 Subgrade Preparation

The surface underlying the geotextile shall be smooth and free of ruts or protrusions which could damage the geotextile.

3.2.2 Placement

The Contractor shall notify the Contracting Officer a minimum of 24 hours prior to installation of geotextile. Geotextile rolls which are damaged or contain imperfections shall be repaired or replaced as directed. The geotextile shall be laid flat and smooth so that it is in direct contact with the subgrade. The geotextile shall also be free of tensile stresses, folds, and wrinkles. On slopes steeper than 10 horizontal on 1 vertical, the geotextile shall be laid with the machine direction of the fabric parallel to the slope direction.

3.3 SEAMS

3.3.1 Overlap Seams

Geotextile panels shall be continuously overlapped a minimum of 300 mm at all longitudinal and transverse joints. Where seams must be oriented across the slope, the upper panel shall be lapped over the lower panel. If approved, sewn seams may be used instead of overlapped seams.

3.3.2 Sewn Seams

Factory and field seams shall be continuously sewn at the locations shown on the drawings. The stitch type used shall be a 401 locking chain stitch or as recommended by the manufacturer. Quality Assurance seam samples shall be provided to the Government at the request of the Contracting Officer. Seam strength shall meet the minimum requirements specified in Table 1. The thread at the end of each seam run shall be tied off to prevent unraveling. Skipped stitches or discontinuities shall be sewn with an extra line of stitching with a minimum of 450 mm of overlap.

3.4 PROTECTION

The geotextile shall be protected during installation from clogging, tears, and other damage. Damaged geotextile shall be repaired or replaced as directed. Adequate ballast (e.g. sand bags) shall be used to prevent uplift by wind. The geotextile shall not be left uncovered for more than 14 days after installation.

3.5 REPAIRS

Torn or damaged geotextile shall be repaired. Clogged areas of geotextile shall be removed. Repairs shall be performed by placing a patch of the same type of geotextile over the damaged area. The patch shall extend a minimum of 300 mm beyond the edge of the damaged area. Patches shall be continuously fastened using approved methods. The machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Geotextile rolls which cannot be repaired shall be removed and replaced. Repairs shall be performed at no additional cost to the Government

3.6 PENETRATIONS

Engineered penetrations of the geotextile shall be constructed by methods recommended by the geotextile manufacturer.

3.7 COVERING

Geotextile shall not be covered prior to inspection and approval by the Contracting Officer. Cover soil shall be placed in a manner that prevents soil from entering the geotextile overlap zone, prevents tensile stress from being mobilized in the geotextile, and prevents wrinkles from folding over onto themselves. On side slopes, soil backfill shall be placed from the bottom of the slope upward. Cover soil shall not be dropped onto the geotextile from a height greater than 1 m. No equipment shall be operated directly on top of the geotextile without approval of the Contracting Officer. Equipment with ground pressures less than 50 kPa shall be used to place the first lift over the geotextile. A minimum of 300 mm of soil shall be maintained between full-scale construction equipment and the geotextile. Cover soil material type, compaction, and testing requirements are described in Section 02722. Equipment placing cover soil shall not stop abruptly, make sharp turns, spin their wheels, or travel at speeds exceeding 2.2 m/s.

-- End of Section --

SECTION 02510A

WATER DISTRIBUTION SYSTEM

12/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1999) Liquid Chlorine
AWWA C651	(1999) Disinfecting Water Mains

ASTM INTERNATIONAL (ASTM)

ASTM D 2657	(1997) Heat Fusion Joining Polyolefin Pipe and Fittings
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1.2 PIPING

This section covers water aboveground building water service lines and supports for same. The Contractor shall have a copy of the manufacturer's recommendations for each material or procedure to be utilized available at the construction site at all times.

1.3 MANUFACTURER'S REPRESENTATIVE

The Contractor shall have a manufacturer's field representative present at the jobsite during the installation and testing of the lines to provide technical assistance and to verify that the materials are being installed in accordance with the manufacturer's prescribed procedures. When the representative feels that the Contractor is installing and testing the lines in a satisfactory manner, certification shall be written to note which individuals employed by the Contractor are capable of properly installing the pipe. The field representative shall advise the Contractor of unsatisfactory conditions immediately when they occur. Such conditions include improper diameter of pipe ends, damaged components, poorly prepared joints, improper curing of joints, moving pipe before joints are cured, bending pipe to follow abrupt changes in elevation, leaving pipe ends open overnight, not properly drying joints after rain storms, exceeding effective adhesive life, improper support of pipe, or any other condition which could have an adverse effect on the satisfactory completion and operation of the piping system.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Installation

The manufacturer's recommendations for each material or procedure to be utilized.

Satisfactory Installation

A statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract drawings and specifications, and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

SD-06 Test Reports

Bacteriological Disinfection

Test results from commercial laboratory verifying disinfection.

SD-07 Certificates

Manufacturer's Representative

The name and qualifications of the manufacturer's representative and written certification from the manufacturer that the representative is technically qualified in all phases of the pipe setting and jointing and experienced to supervise the work and train the Contractor's field installers, prior to commencing installation.

Installation

A statement signed by the manufacturer's field representative certifying that the Contractor's personnel are capable of properly installing the pipe on the project.

SD-08 Shop Drawings

Contractor shall provide shop drawings of pipe and pipeline support for review and approval.

1.5 HANDLING

Pipe and accessories shall be handled to ensure delivery to the site in sound, undamaged condition, including no injury to the pipe outer jacket, insulation, or carrier pipe. Pipe shall be carried into position and not dragged. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being set and shall be kept clean during setting operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after setting shall be replaced with sound material without additional expense to the Government.

PART 2 PRODUCTS

2.1 PIPE, COUPLINGS, PIPE ACCESSORIES AND VALVES

Pipe, couplings, pipe accessories and valves shall conform to the respective specifications and other requirements specified below. Supports to be as detailed and specified on the drawings.

a. Manufacturers

1. KWH Pipe (Danmark) A/S, DK-4060 Kirke Saby
2. Substitutions: Section 01600 PRODUCT REQUIREMENTS

Pipe PE-100 (Polyethylene) PN 10

Jacket SPIRO (Galvanized) 1 mm, 1.25 mm for pipes greater than or equal to 125 mm

Insulation PUR (Polyurethane), Density 80 kg/m³, and 0.033 w/m degree K at 50 degree C

Tracer Aluminum Profiles, 3 (EA) placed at 4, 8 and 12 o'clock, manufactured for carrying up to 10 W/ft. Raychem Cable type BTV2CT (18x8 mm cable)

b. Schedule for insulation thickness.

Carrier pipe/insulation jacket

90/315 mm Diameters
125/400 mm Diameters
150/450 mm Diameters
200/500 mm Diameters
250/500 mm Diameters
315/560 mm Diameters

c. Spacing for support to be maximum.

2.5 m's for pipes 90/315 mm Diameters
3.0 m's for pipes 125/400 mm Diameters
3.0 m's for pipes 150/450 mm Diameters
3.5 m's for pipes 200/500 mm Diameters
4.0 m's for pipes 250/500 mm Diameters
4.0 m's for pipes 315/560 mm Diameters

2.2 COUPLINGS

Couplings and flanges between new and existing piping, shall be made of fittings of proper type in accordance with mentioned codes and regulations.

2.3 PIPE ACCESSORIES

- a. All accessories shall be prefabricated suitable for water piping.
- b. Pipe Joints: Use electro couplings and personnel to be certified.
- c. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps, and other configurations required. Fittings to be pre-insulated. Use saddle pieces for branch connections.

2.4 PIPE HANGERS AND SUPPORTS

- a. Spacing for support to be maximum:
 - 2.5 m's for pipes 90/315 mm Diameters
 - 3.0 m's for pipes 125/400 mm Diameters
 - 3.5 m's for pipes 200/500 mm Diameters
 - 4.0 m's for pipes 250/500 mm Diameters
 - 4.0 m's for pipes 315/560 mm Diameters
- b. Manufacturing of supports to be in accordance with drawings.

2.5 VALVES

- a. Manufacturers:
 - 1. AVK International A/S, Bizonvej 1, DK-8464 Galten
 - 2. Substitutions: Section 01600 PRODUCT REQUIREMENTS
- b. Section and branch valves outside and inside buildings are to be the following: AVK Gate Valve, Series 06/30, Epoxy coating DIN 30677, Flange DIN 2501 PN16, including control rod, extension box, insulation and valve key.
- c. Air Vent and vacuum release: Shall be prefabricated suitable for water piping consisting of connection piece and air vent valves to be 316L stainless steel construction with high handle.
- d. Drain shall be prefabricated suitable for water piping consisting of connection piece, valve and outlet. For each drain valve there shall be mounted an air inlet (vacuum release) valve on top of pipe. Drain valves shall be 316L stainless steel construction with high handle.
- e. Enclosure for valves, air vents and drains: Shall be manufactured, pre-insulated and heat traced as specified for pipes. Use prefabricated saddle pieces as insulation joint jacket.

2.6 BANDS FOR INSULATING JACKETS

To be 1/2 inch x 0.030 inch with reusable locks. Bands and locks to be made of 316 or 301 stainless steel.

2.7 MISCELLANEOUS ITEMS

2.7.1 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

PART 3 EXECUTION

3.1 INSTALLATION

Connection to main and installation of pipe to be done in accordance with pipe assembly manufacturers recommendations. Carefully remove outer jacket and insulation at main. Inspect pipe for suitable point of connection. Once suitable point of connection is found, properly prepare main for modification to allow lateral connection. Connect lateral per drawing details, test, apply heat tracing, reinsulate, and install new outer jacketing and seal.

3.1.1 Joint Deflection

3.1.1.1 Offset for Flexible Plastic Pipe

Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer, but shall not exceed 5 degrees.

3.1.2 Jointing

3.1.2.1 PE Pipe Requirements

Jointing shall comply with ASTM D 2657, Technique I-Socket Fusion or Technique II-Butt Fusion.

3.2 EXAMINATION

Section 01300 ADMINISTRATIVE REQUIREMENTS: Verification of existing conditions before starting work.

Verify connection sizes, locations, and inverts are as indicated on Drawings.

Welding requirements: In accordance with DS 2383 and manufactures recommendations.

3.3 INSTALLATION - PIPE

Group piping with other site piping work whenever practical.

Route pipe in straight line.

Install pipe to allow for expansion and contraction without stressing pipe or joints.

Install access fittings to permit disinfections of water system.

Install pipe, fittings, and accessories in accordance with mentioned codes and regulations. Seal joints watertight.

Install in accordance with the pipe manufacturer's recommendations.

Install pipe into building and install sleeve and weather seal at building penetration point.

3.4 HYDRO TESTING

Test in accordance with pipe manufacturer's recommendations, base standards, and Danish test procedures.

3.5 BACTERIOLOGICAL DISINFECTION

3.5.1 Disinfection Procedure

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as prescribed by AWWA C651.

3.5.2 Sampling

From several points in the unit, personnel from the Contractor's commercial laboratory shall take at least 3 water samples from different points, approved by the Contracting Officer, in proper sterilized containers and perform a bacterial examination in accordance with approved methods. The commercial laboratory shall be properly certified for examination of potable water.

3.5.3 Acceptance Requirements

The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained.

3.6 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed. The Contractor shall submit a statement of Satisfactory Installation as specified in the Submittals paragraph.

-- End of Section --

SECTION 02531

SANITARY SEWERS

07/03

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

1.1.1 Aboveground Sanitary Sewer Gravity Pipeline

Provide building laterals (and mains if shown on drawings) of preinsulated and jacketed polyethylene pipe and run into building.

1.2 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers from inside the building to points where the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Supports to be as detailed on the drawings. Before, during, and after installation, pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe materials shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Supports

Assembly techniques

SD-03 Product Data

Pipeline materials and supports

Submit manufacturer's standard drawings or catalog cuts.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

1.4.1.1 Piping System Materials

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store piping and fittings under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.4.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.4.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the supports in sound undamaged condition. Take special care not to damage linings of pipe and fittings. Carry, do not drag, pipe to points of installation.

PART 2 PRODUCTS

2.1 PIPELINE MATERIALS AND SUPPORTS

Pipe shall conform to the respective specifications and other requirements specified below.

a. Manufacturers

1. KWH Pipe (Danmark) A/S, DK-4060 Kirke Saby

2. Substitutions: Section 01600 PRODUCT REQUIREMENTS

Pipe PE-100 (Polyethylene) PN 10

Jacket SPIRO (Galvanized) 1 mm, 1.25 mm for pipes greater than or equal to 125 mm

Insulation PUR (Polyurethane), Density 80 kg/m³, and 0.033 w/m degree K at 50 degree C

Tracer Aluminum Profiles, 2 (EA) placed at 4 and 8 o'clock, manufactured for carrying up to 10 W/ft. Raychem Cable type BTV2CT (18x8 mm cable)

b. Schedule for insulation thickness:

Carrier pipe/insulation jacket

90/315 mm Diameters
125/400 mm Diameters
150/450 mm Diameters
200/500 mm Diameters
250/500 mm Diameters
315/560 mm Diameters

c. Spacing for support to be maximum:

2.5 m's for pipes 90/315 mm Diameters
3.0 m's for pipes 125/400 mm Diameters
3.0 m's for pipes 150/450 mm Diameters
3.5 m's for pipes 200/500 mm Diameters
4.0 m's for pipes 250/500 mm Diameters
4.0 m's for pipes 315/560 mm Diameters

2.2 COUPLINGS

Couplings and flanges between new and existing piping, shall be made of fittings of proper type in accordance with mentioned codes and regulations.

2.3 PIPE ACCESSORIES

- a. All accessories shall be prefabricated suitable for sanitary piping.
- b. Pipe Joints: Use electro couplings and personnel to be certified.
- c. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, and other configurations required. Fittings to be pre-insulated. Use saddle pieces for branch connections.

2.4 PIPE HANGERS AND SUPPORTS

a. Spacing for support to be maximum:

2.5 m's for pipes 90/315 mm Diameters
3.0 m's for pipes 125/400 mm Diameters
3.0 m's for pipes 150/450 mm Diameters
3.5 m's for pipes 200/500 mm Diameters
4.0 m's for pipes 250/500 mm Diameters
4.0 m's for pipes 315/560 mm Diameters

b. Manufacturing of supports to be in accordance with drawings.

PART 3 EXECUTION

3.1 EXAMINATION

Section 01300 ADMINISTRATIVE REQUIREMENTS: Verification of existing conditions before starting work.

Verify building service connection and site main size, location, and invert

is as indicated on Drawings.

3.2 PREPARATION

Remove scale and dirt on inside and outside of pipe and fittings before assembly.

3.3 INSTALLATION - PIPE

Install per pipe manufacturers recommendations.

Group piping with other site piping work whenever practical.

Route pipe in straight line.

Install pipe to allow for expansion and contraction without stressing pipe or joints.

3.4 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.4.1 General Requirements for Installation of Pipelines

3.4.2 Miscellaneous Construction and Installation

3.4.2.1 Connecting to Existing Mains

Connection to main and installation of pipe to be done in accordance with pipe assembly manufacturers recommendations. Carefully remove outer jacket and insulation at main. Inspect pipe for suitable point of connection. Once suitable point of connection is found, properly prepare main for modification to allow lateral connection. Connect lateral per drawing details, test, apply heat tracing, reinsulate, and install new outer jacketing and seal.

3.5 FIELD QUALITY CONTROL

3.5.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.5.2 Tests for Nonpressure Lines

3.5.2.1 Leakage Tests

Test lines for leakage by low-pressure air tests. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

a. Low-pressure air tests: Perform tests as follows:

(1) Polyethylene pipelines: Test in accordance with manufacturers recommendations and base standards.

-- End of Section --

SECTION 02554A

ABOVEGROUND HEAT DISTRIBUTION SYSTEM

12/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI O5.1 (2002) Specifications and Dimensions for
Wood Poles

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C1 (2000) All Timber Products - Preservative
Treatment by Pressure Processes

AWPA C2 (2001) Lumber, Timber, Bridge Ties and
Mine Ties - Preservative Treatment by
Pressure Processes

AWPA C4 (1999) Poles - Preservative Treatment by
Pressure Processes

AWPA P5 (2002) Standard for Waterborne
Preservatives

ASME INTERNATIONAL (ASME)

ASME B1.20.1 (1983; R 2001) Pipe Threads, General
Purpose, Inch

ASME B16.11 (2002) Forged Fittings, Socket-Welding and
Threaded

ASME B16.34 (1996) Valves Flanged, Threaded, and
Welding End

ASME B16.9 (2001) Factory-Made Wrought Steel
Buttwelding Fittings

ASME B31.1 (2001) Power Piping

ASME BPVC SEC IX (2001) Boiler and Pressure Vessel Code;
Section IX, Welding and Brazing
Qualifications

ASTM INTERNATIONAL (ASTM)

ASTM A 105/A 105M	(2002) Carbon Steel Forgings for Piping Applications
ASTM A 106	(2002a) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 234/A 234M	(2002) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A 475	(1998) Zinc-Coated Steel Wire Strand
ASTM C 547	(2003) Mineral Fiber Pipe Insulation
ASTM F 1139	(1988; R 1998) Steam Traps and Drains

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-45	(2003) Bypass and Drain Connections
MSS SP-80	(2003) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(2001) Class 3000 Steel Pipe Unions, Socket-Welding and Threaded

1.2 SYSTEM DESCRIPTION

This specification covers the furnishing of materials for and the installation of the preinsulated and jacketed, aboveground heat (steam and condensate) distribution system. The contract drawings show the arrangement of piping, supports and the routing of the heat distribution system. Other details, such as sizes of piping, location of expansion loops, location of valves and items of equipment, are also shown on the contract drawings. This specification covers the installation of the system into the building which it serves.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Materials and Equipment

Complete fabrication and assembly drawings for all parts of the work in sufficient detail to check conformity with the requirements of the contract documents. The proposed layout for the aboveground heat distribution system including provisions for pipe expansion, pipe anchors and guides, and supports shall be shown in plan views and pipe profile elevations. Details and calculations, including expansion stress calculations, required to demonstrate that the system has been coordinated and will properly function as a unit shall be included.

SD-03 Product Data

Materials and Equipment; G

Data composed of catalog cuts, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Welding Procedures and Qualifications

6 copies of qualified procedures and lists of names and identification symbols of qualified welders and welding operators, prior to welding operations.

SD-10 Operation and Maintenance Data

Distribution System; G

Six copies of operation and six copies of maintenance manuals for the equipment furnished; one complete set prior to performance testing and the remainder furnished upon acceptance. Operation manuals shall detail the step-by-step procedures required for equipment startup, operation, and shutdown. Operation manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the equipment as installed. Manuals shall be approved prior to the field performance testing.

1.4 WELDING PROCEDURES AND QUALIFICATIONS

Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if possible. The welder or welding operator shall apply his assigned symbol near each weld he makes as

a permanent record. Structural members shall be welded in accordance with Section 05090A WELDING, STRUCTURAL.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

1.6 DELIVERY AND STORAGE

After delivery to the jobsite, materials and equipment shall be protected from anything which could cause damage to the material or equipment. Pipe shall be sealed at each end to keep the interior clean and free of dirt and debris. Fittings shall be kept together and their interior surfaces shall remain clean. Any insulation stored shall be kept dry and clean.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be the standard products of manufacturers regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.2 PIPING

2.2.1 General

Unless otherwise specified, steel pipe, fittings, valves, and piping accessories shall conform to the requirements of ASME B31.1, and shall be suitable for the indicated pressure and temperature requirements. Joints for ferrous piping shall be welded, except that joints 20 mm and smaller may be threaded. Pipe shall be seamless or electric resistance welded conforming to ASTM A 106, Grade B. Steel pipe 40 mm in diameter and smaller shall be seamless conforming to ASTM A 106, Grade B.

2.2.2 Supply Pipe

Steam pipes shall be black steel Schedule 40 with plain end beveled. Nominal pipe sizes 25 mm and below shall be Schedule 80.

2.2.3 Condensate Return Pipes

Condensate return pipes shall be black steel, Schedule 80 with plain end beveled.

2.2.4 Drip, Vent, Relief, and Gauge Pipe

Drip, vent, relief, and gauge connecting pipe and threaded pipe shall be black steel, Schedule 80.

2.3 FITTINGS

2.3.1 Threaded Fittings

Threaded fittings shall conform to the requirements of ASME B16.11, Pressure Class 150, Grinnel Anvil.

2.3.2 Unions

Unions shall conform to the requirements of MSS SP-83.

2.3.3 Welding Fittings

Forged steel welding fittings shall conform to the requirements of ASTM A 105/A 105M/ or ASTM A 234/A 234M Class 3000. Welding fittings shall also conform to ASME B16.9 for butt-weld fittings and ASME B16.11 for socket-weld fittings. Long radius butt-welding elbows conforming to ASME B16.9 shall be used whenever space permits. Fittings to be Grinnel Anvil.

2.3.4 Pipe Threads

Pipe threads shall conform to ASME B1.20.1. Pipe to be threaded shall be Schedule 80.

2.4 VALVES

2.4.1 General

Unless otherwise specified, ferrous and nonferrous valves shall meet the material, fabrication and operating requirements of ASME B31.1. Valves furnished shall be suitable for the temperature and pressure requirements of the system on which they are to be installed. Valves for steam and condensate shall conform to ASME B31.1 as suitable for the application. Valves 150 mm and larger shall have a 25 mm minimum gate or globe bypass valve sized in conformance with MSS SP-45. Valves shall have the manufacturer's trademark.

2.4.2 Valves

2.4.2.1 Ball Valves

Ball valves to be Spirax Sarco M 10 S for sizes DN 1/4 inch through DN 2-1/2 inch..

2.4.2.2 Check Valves

Check valves shall conform to the requirements of MSS SP-80. Valves to be NAF Figures N 400 P or N 400 B piston or ball check valves, Class 150, with ASTM 105N bodies and bonnets, AISI 420 balls/pistons, AISI 410 seals, and stainless steel springs.

2.4.3 Steel Valves

Steel globe, gate, angle and check valves shall conform to the requirements of ASME B16.34 and ASME B31.1 for the temperature and pressure requirements of the system.

2.4.4 Packing

Packing used with valves shall not contain asbestos. Valve stem packing shall be die-formed, ring type specifically designated as suitable for the temperature and pressure of the service and compatible with the fluid in the system. Packing rings shall be polytetrafluoroethylene with minimum 50 percent graphite filament top and bottom rings. Valves 40 mm and smaller shall have 4 or 5 packing rings, and valves 50 mm and larger shall have at least 6 packing rings. Spiral or continuous packing will not be acceptable. A metal insert shall be provided having proper clearance around the valve stem at the bottom of the stuffing box and acting as a base for the packing material. Packing glands shall be furnished with a liner of noncorrosive material and shall be of 1 piece construction with provisions for not less than 2 bolts for packing adjustment.

2.5 STEAM TRAPS

2.5.1 General

Class of trap bodies shall be suitable for a working pressure of not less than 1.5 times the steam supply pressure, but not less than 1.38 MPa, and traps shall be capable of operation under a steam-supply pressure as indicated. Traps shall have capacities as shown when operating under the specified working conditions. Traps shall fail open.

2.5.2 Bimetallic Traps

Traps shall be bimetallic element type with automatic air discharge conforming to ASTM F 1139. Spirax Sarco SM21Y.

2.5.3 Solenoid Valves

Solenoid valves to be Danfoss Type EVSIS 3-20.

2.5.4 Steam Trap Fault Detectors

Steam trap fault detectors to be Spirax Sarco Spiratec ST 16.

2.6 STRAINERS

Strainers to be Spirax Sarco Figure 14. Y-type strainer body connections shall be the same size as the pipelines in which the strainers are installed. The strainer bodies for steam systems shall be heavy and durable, of cast steel, with bottoms drilled and plugged. The strainers shall be suitable for the temperature and pressure requirements of the system on which they are installed. The bodies shall have arrows clearly cast on the sides to indicate the direction of flow. Each strainer shall be equipped with an easily removable cover and sediment basket. The body

or bottom opening shall be equipped with nipple and gate valve for blowdown. The basket for steam systems shall be not less than 0.6350 mm thick stainless steel, Monel or sheet brass, with small perforations of sufficient number to provide a net free area through the basket of at least 2.5 times that of the entering pipe. The flow shall be into the basket and out through the perforations. For high temperature hot water systems, only cast steel bodies and stainless or Monel baskets shall be used.

2.7 ABOVEGROUND PIPE SUPPORTS (see drawings for more details/specifications)

2.7.1 Steel

Steel used as support members or as part of the pipe support structure shall conform to the requirements of Section 05120 STRUCTURAL STEEL. To the maximum extent possible, the pipe supports shall be hot-dipped galvanized after they have been fabricated.

2.7.2 Wood Poles and Lumber

Wood poles shall conform to the requirements of ANSI O5.1, Class 3, treated southern pine, machine trimmed to a smooth surface, free of crooks or sweeps exceeding 10 mm per 1.0 m of pole length, and bored, galled and roofed before treatment. Wood poles shall be pressure treated with nonleaching water-borne preservative, ACA or CCA conforming to AWPAC P5. Treatment shall be in accordance with AWPAC C1 and AWPAC C4. Poles shall be furnished with pole caps. Lumber shall be No. 1 dense stress grade southern pine, pressure treated with nonleaching water-borne preservative, ACA or CCA conforming to AWPAC P5. Treatment shall be in accordance with AWPAC C1 and AWPAC C2.

2.7.3 Accessories

The following accessories shall be furnished as needed to support the poles and/or to maintain the alignment of the aboveground structure. Materials shall have a hot-dipped galvanized finish.

2.7.3.1 Guy Wires

Guy wires shall conform to the requirements of ASTM A 475, extra high strength grade, extra galvanized, stranded with 7 or 19 wires in each strand. Thimbles shall be provided at each end of guy wires.

2.7.3.2 Anchor Rods

Anchor rods shall be 32 mm diameter threaded rod with oval eye.

2.7.3.3 Screw Anchors

Screw anchors shall be 250 mm diameter.

2.7.3.4 Turnbuckles

Turnbuckles shall be the open type, forged body, with jaw and jaw end pulls, 10 mm size and hot-dipped galvanized.

2.7.3.5 Clamps

Clamps shall be forged high carbon steel fitted with galvanized heat treated bolts of best commercial grade. Clamps shall be capable of developing full strength of the guy wire. Two clamps at each connection of the guy wire shall be provided.

2.8 INSULATION SYSTEMS

2.8.1 Insulation

The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Insulation for piping, fittings, and valves shall be a two-layer LR Industries sliding system using molded mineral fiber (Rockwool) insulation conforming to the requirements of ASTM C 547, Class 2 under a layer of PUR foam. The mineral wool material is to have a density of 75 kg/m³ for <323 mm diameter and a density of 40 kg/m³ for >323 mm diameter, <1% water absorption, 0.01 M/mm² compressive strength, and a maximum thermal conductivity at 50 degree C of 0.04 w/m-k. PUR insulation to be hard polyurethane with a core density of \geq 60 kg/m³, a 10% deformation compressive strength of greater than or equal to 0.3 N/mm², and a maximum thermal conductivity at 50 degree C of 0.03 w/m-k. The inner layer of insulation must ensure that the PUR insulation temperature never exceeds 140°C. The thickness of insulation used on aboveground piping shall be as shown in Table 1 where diameter 1 is the outer diameter of the carrier pipe, diameter 2 is the outer diameter of the mineral wool layer, and diameter 3 is the outer diameter of the PUR layer.

TABLE 1

Diameter 1 (mm)	Diameter 2 (mm)	Diameter 3 x s (mm)
323.9	401	630 x 1.2
273.0	349	555 x 1.2
219.1	297	500 x 1.2
168.3	228	400 x 1.2
114.3	174	315 x 1.2
88.9	128	280 x 1.2
60.3	100	280 x 1.2
48.3	92	250 x 1.0
76.6	140	280 x 1.2

2.8.2 Insulation Jackets

2.8.3 Galvanized Steel Jackets

Galvanized steel jackets to be weatherproof spiral wound type, A/S Star Pipe (Danmark), 1.0 mm and 1.2 mm thicknesses (1.2 mm for diameters > 250 mm).

2.8.4 Adhesives

Adhesives to be in accordance with insulation manufacturers requirements.

2.9 PIPE SLEEVES AND SEALS

Sleeves in building walls and seals shall be as shown on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number on a plate secured to the item of equipment.

Connection to main and installation of new lines to be done in accordance with pipe assembly manufacturers recommendations. Carefully remove outer jacket and insulation at main. Inspect pipe for suitable point of connection. Once suitable point of connection is found, properly prepare main for modification to allow lateral connection. Connect lateral per drawing details, test, reinsulate, and install new outer jacketing and seal.

3.1.1 Support Structures

Pipes shall be supported by concrete and steel, or wood structures as indicated. Structures shall be set, plumbed and guyed as required. Guy wires shall be stressed until taut. Elevation of the structures shall be as indicated on the drawings. Painting of structural steel members shall be as specified in Section 09900 PAINTING, GENERAL.

3.1.2 Piping, Valves, and Traps

3.1.2.1 Piping

Installation of the heat distribution system shall be in accordance with ASME B31.1, unless otherwise specified or indicated. Piping shall be installed straight and true to bear evenly on supports. Changes in direction shall be made by pipe fittings. Changes in horizontal steam piping sizes shall be made using eccentric reducing fittings to keep bottom of pipe at the same level. Horizontal steam piping, unless otherwise indicated, shall be pitched with a grade of not less than 25 mm in 6 m in the direction of flow. All other piping, unless otherwise indicated, shall be pitched with a grade of not less than 20 mm in 10 m toward the drain points. Pipe shall be accurately cut to measurements established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Excessive cutting or other weakening of structural members to facilitate piping installation will not be permitted. Pipe ends shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints or hangers. Open ends of pipe lines and equipment shall be properly capped or plugged during installation to keep dirt or other foreign matter out of the system.

3.1.2.2 Valves

Valves shall be installed with stems horizontal or above. Valves shall be welded, except sizes smaller than 20 mm may have threaded end connections with a union on one side of the valve.

3.1.2.3 Traps

Steam traps are to be applied and installed per the trap manufacturers recommendations, and per base standards.

3.1.3 Joints

3.1.3.1 Welded Joints

Joints between sections of pipe and between pipe and fittings shall be welded, except where threaded fittings are allowed and used. Branch connections may be made with either welding tees or forged branch outlet fittings, either being acceptable without size limitations. Where branch outlet fittings are used, they shall be forged, flared for improved flow where attached to the run, reinforced against external strains, and designed to withstand full pipe bursting strength. Threaded joints in high temperature water systems shall be seal welded.

3.1.3.2 Threaded Joints

Threaded joints shall be made tight with polytetrafluoroethylene tape applied to the male pipe threads only.

3.1.4 Branch Connections

Branch connections from supply and return mains shall be installed as indicated or as approved. Connections shall be carefully made to ensure unrestricted circulation, eliminate air pockets, and permit the complete drainage of the system.

3.1.5 Pipe Supports

Horizontal and vertical runs of pipe shall be securely supported. Pipe hangers, guides, brackets, supports and anchors shall be as detailed on the drawings. Spacing for the pipe supports shall be in accordance with the pipe system manufacturers guidelines. For hangers located on the outside of the insulation, a preformed, minimum 450 mm long, full round, 2 mm, galvanized steel saddle shall be positioned between the hanger and the insulation. The saddle shall be of sufficient size and thickness to limit the compressive load on the insulation to 228 kPa.

3.1.6 Pipe Sleeves

Pipe sleeves shall be provided where piping passes through walls. Sleeves shall be secured in proper position and location during construction. Sleeves shall be of sufficient length to pass through the entire thickness of walls. The annular space between the exterior of piping or pipe insulation and the interior of the sleeve shall be not less than 8 mm; and

the space shall be firmly packed with insulation and both ends of the sleeve shall be caulked with plastic waterproof cement which will cure to a firm but pliable mass.

3.2 INSULATION

3.2.1 General

Insulation shall be installed in a manner that prevents damage by pipe expansion or contraction. Insulation installed over welds shall be grooved to assure a snug fit. Insulation shall be held in place with stainless steel straps or wire. All flanges, unions, valves, and fittings shall be insulated with premolded, prefabricated, or field fabricated segments of insulation of the same material and thickness as the adjoining pipe insulation.

3.2.2 Installation

Except as otherwise specified, material shall be installed in accordance with the recommendations of the manufacturer. Insulation materials shall not be applied until tests specified are completed, foreign material such as rust, scale, or dirt has been removed, and the surfaces are clean and dry. Insulation shall be kept clean and dry at all times.

3.2.3 Wet Insulation

3.2.3.1 Prior to Installation

Insulation which has become wet prior to installation shall be thoroughly dried before proceeding with the installation. After drying, a representative cross section of the insulation, as determined by the Contracting Officer, shall be taken and quickly placed in an airtight container for a moisture determination. The sample shall be weighed in the airtight container on an accurate balance or scale, after which the container shall be opened and placed in an oven at 102 degrees C until its weight becomes constant. The percentage of water by weight shall be determined from the initial and final weight of the container and the sample after appropriate corrections are made for the weight of the empty container. The average water content of the sample shall not exceed 5 percent by weight. If the average water content of the insulation exceeds 5 percent by weight, the insulation shall be replaced with dry insulation.

3.2.3.2 After Installation

Insulation which becomes wet during or after installation shall be thoroughly dried by applying heat through the carrier pipe and allowing the moisture to evaporate to the atmosphere. A sample of the insulation shall be checked for water content in accordance with the guidance in the preceding paragraph. The insulation shall be dried until it is found to contain an average water content of less than 5 percent by weight. If approved by the Contracting Officer, installed insulation may be removed and dried in accordance with the guidance in the preceding paragraph and after drying, reinstalled.

3.2.4 Covering of Insulation

Insulation for pipe, flanges, valves, and fittings shall be covered with a jacket as specified by one of the following methods.

3.2.4.1 Steel Jacket

The circumferential seams shall be lapped not less than 75 mm by using compatible galvanized steel coupling sleeves. The coupling sleeves shall be secured with bands or bolts. Jackets on horizontal lines shall be installed so that the longitudinal seams are on the bottom side of the pipe with the seam of each jacket slightly offset from the seam of the adjacent jackets. The seams of jackets installed on vertical lines shall be placed on the off-weather side of the pipe and shall be slightly offset as on horizontal lines. The jackets on vertical lines and lines pitched from the horizontal shall be installed from low point to high point so that the lower circumferential edge of each jacket overlaps the upper circumferential edge of the jacket below it. Joints shall be sealed with a moisture barrier. Jackets for fittings, valves, and flanges to consist of custom fabricated galvanized steel enclosures which are insulated and sealed.

The jacketing shall not be allowed to become electrically coupled to the piping.

3.3 PIPE GUIDES AND SUPPORTS

Pipe supports and alignment guides shall be provided as indicated or necessary and shall permit pipe expansion and contraction without damage to the insulation. The supports, anchors, and guides shall be designed to permit complete drainage of the system, shall have rigid steel frames of adequate strength and corrosion resistance for the service, and shall be securely embedded in concrete or securely attached to the piping supports. Pipe supports shall be equipped with steel bars and cast-iron rollers.

3.4 PIPE EXPANSION

Expansion shall be accommodated by loops and bends as indicated on the drawings and as specified. Pipe in the loops and bends shall accommodate expansion while maintaining required insulation clearance from other pipes; crushing or breaking of insulation shall be avoided. Expansion loops may be designed around obstacles such as structures, or trees to avoid construction conflicts. Slopes of pipe shall be maintained. Contractor shall have the option to adjust the loop dimensions around obstacles based on final field measurements, if approved by the Contracting Officer. Contractor shall submit pipe stress calculations for each revised expansion loop or bend based on the final actual measured lengths, or shall submit dimensions to the Contracting Officer for verification of loop and bend sizes before proceeding with that segment of work. Allowable pipe stresses shall be in accordance with ASME B31.1. Final expansion loop insulation method shall be submitted for approval to the Contracting Officer.

3.5 TESTS

3.5.1 General

Tests shall be conducted before, during, and after the installation of the system. Instruments, equipment, facilities, and labor required to properly conduct the tests shall be provided by the Contractor. Test pressure gauges for a specific test shall be approved by the Contracting Officer and shall have dials indicating not less than 1-1/2 times nor more than 2 times the test pressure. Any deficiencies found shall be corrected and the system retested.

3.5.2 Cleaning of Piping

Prior to the hydrostatic and operating tests, the interior of the pipe shall be cleaned of all foreign material by thorough flushing with clean water. Supplementary pumps shall be provided to circulate the flushing liquid at a velocity between 2 and 3 meters per second for a minimum of 4 hours. Temporary strainers shall be installed as required. After flushing, the flushing liquid shall be drained out of the piping system and the piping system shall be filled with clean water.

3.5.3 Field Tests

3.5.3.1 Hydrostatic Tests of Service Piping

Service piping shall be tested hydrostatically before insulation is applied at the joints and shall be proved tight at a pressure 1-1/2 times the working pressure or at 1.38 MPa, whichever is greater, except high temperature water lines shall not be tested at more than 3.48 MPa. Hydrostatic test pressures shall be held for a minimum of 4 hours. If any failures occur, the Contractor shall make such adjustments, repairs or replacements as the Contracting Officer may direct, and the tests shall be repeated until satisfactory installation and operation are achieved.

3.5.3.2 Equipment

Valves, traps, alarms, controls and other operable items of equipment that are a part of the aboveground heat distribution system shall be checked to show proper operation. These checks shall be performed in the presence of the Contracting Officer or his representative.

3.5.3.3 Operational Tests

Operational test shall be performed on the complete system or testable portions thereof. The test shall be conducted with full design flows and operating temperatures in all runs of piping as if in service, to demonstrate satisfactory function and operating effectiveness. The operational test shall have 2 cycles. Each cycle shall consist of a 6-hour period with water in the system at the maximum operating temperature and maximum flow rate; and a period of at least 6 hours with no flow rate. For dual temperature systems, the first cycle shall use the heating temperature and the second cycle the cooling temperature of the designed system. The Contractor shall supply all items necessary to perform the test including

temporary pumps, piping connections, boilers, chillers and the gauges required to circulate the water at the desired temperatures and flow rates.

Water shall be circulated through supply lines and returned through the return piping to demonstrate that the pressure drop is compatible with the flow rate and size of pipe; and to show that obstructions do not exist in the piping system. Any unusual indicated pressure drop shall be investigated and any obstructions removed. Leaks found shall be repaired. After obstructions have been removed and leaks repaired, the carrier piping tests shall be repeated.

-- End of Section --

SECTION 02722A

AGGREGATE AND/OR GRADED-CRUSHED AGGREGATE BASE COURSE
05/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 117	(2003) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 127	(2001) Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C 128	(2001e1) Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C 131	(2003) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(2001) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 29/C 29M	(1997; R 2003) Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C 88	(1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2002) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2487	(2000) Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 75	(2003) Sampling Aggregates
ASTM E 11	(2001) Wire Cloth and Sieves for Testing Purposes

1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.2.1 Aggregate Base Course

Aggregate base course (ABC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Graded-crushed Aggregate Base Course

Graded-crushed aggregate (GCA) base course is well graded, crushed, durable aggregate uniformly moistened and mechanically stabilized by compaction. GCA is similar to ABC, but it has more stringent requirements and it produces a base course with higher strength and stability.

1.2.3 Degree of Compaction

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

1.3 UNIT PRICES

1.3.1 Measurement

1.3.1.1 Area

The quantity of ABC and GCA completed and accepted, as determined by the Contracting Officer, will be measured in square meters.

1.3.1.2 Volume

The quantity of ABC and GCA completed and accepted, as determined by the Contracting Officer, will be measured in cubic meters. The volume of material in-place and accepted will be determined by the average job thickness obtained in accordance with paragraph THICKNESS CONTROL and the dimensions shown.

1.3.1.3 Weight

The tonnage of ABC and GCA material will be the number of metric tons of aggregate, placed and accepted in the completed course, as determined by the Contracting Officer. Deductions will be made for any material wasted, unused, rejected, or used for convenience of the Contractor, and for water exceeding specified amount at time of weighing.

1.3.2 Payment for Quantities

Quantities of ABC and GCA, determined as specified above, will be paid for at the respective contract unit prices, which shall constitute full compensation for the construction and completion of the ABC and GCA.

1.3.3 Payment for Stabilization of Underlying Course

Stabilization of cohesionless subgrade or subbase courses, as specified in paragraph PREPARATION OF UNDERLYING COURSE, will be paid for as a special item on a tonnage basis. This tonnage price shall include the price of extra manipulation as required.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools

List of proposed equipment to be used in performance of construction work, including descriptive data.

Waybills and Delivery Tickets

Copies of waybills and delivery tickets during the progress of the work. Before the final statement is allowed, the Contractor shall file certified waybills and certified delivery tickets for all aggregates actually used.

SD-06 Test Reports

Sampling and testing

Field Density Tests

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within 24 hours after the tests are performed. Certified copies of test results for approval not less than 30 days before material is required for the work.

1.5 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by a testing laboratory approved in accordance with Section 01451A CONTRACTOR QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements; testing shall be performed at

the specified frequency. The Contracting Officer may specify the time and location of the tests. Copies of test results shall be furnished to the Contracting Officer within 24 hours of completion of the tests.

1.5.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75.

When deemed necessary, the sampling will be observed by the Contracting Officer.

1.5.2 Tests

The following tests shall be performed in conformance with the applicable standards listed.

1.5.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136.

Sieves shall conform to ASTM E 11.

1.5.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.5.2.3 Moisture-Density Determinations

The maximum density and optimum moisture content shall be determined in accordance with ASTM D 1557.

1.5.2.4 Field Density Tests

Density shall be field measured in accordance with ASTM D 1556.

1.5.2.5 Wear Test

Wear tests shall be made on ABC and GCA course material in conformance with ASTM C 131.

1.5.2.6 Soundness

Soundness tests shall be made on GCA in accordance with ASTM C 88.

1.5.3 Testing Frequency

1.5.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements when furnished. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

- a. Sieve Analysis including 0.02 mm size material.

- b. Liquid limit and plasticity index.
- c. Moisture-density relationship.
- d. Wear.
- e. Soundness.

1.5.3.2 In Place Tests

Each of the following tests shall be performed on samples taken from the placed and compacted ABC and GCA. Samples shall be taken and tested at the rates indicated.

a. Density tests shall be performed on every lift of material placed and at a frequency of one set of tests for every 250 square meters, or portion thereof, of completed area.

b. Sieve Analysis including 0.02 mm size material shall be performed for every 500 metric tons, or portion thereof, of material placed.

c. Liquid limit and plasticity index tests shall be performed at the same frequency as the sieve analysis.

1.5.4 Approval of Material

The source of the material shall be selected 30 days prior to the time the material will be required in the work. Tentative approval of material will be based on initial test results. Final approval of the materials will be based on sieve analysis, liquid limit, and plasticity index tests performed on samples taken from the completed and fully compacted ABC and GCA.

1.6 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 2 degrees C. When the temperature falls below 2 degrees C, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.7 PLANT, EQUIPMENT, AND TOOLS

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 AGGREGATES

The ABC and GCA shall consist of clean, sound, durable particles of crushed stone, crushed slag, crushed gravel, crushed recycled concrete, angular sand, or other approved material. ABC shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. GCA shall be free of silt and clay as defined by ASTM D 2487, organic matter, and other objectionable materials or coatings. The portion retained on the 4.75 mm sieve shall be known as coarse aggregate; that portion passing the 4.75 mm sieve shall be known as fine aggregate.

2.1.1 Coarse Aggregate

Coarse aggregates shall be angular particles of uniform density. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements and shall be stockpiled separately.

a. Crushed Gravel: Crushed gravel shall be manufactured by crushing gravels, and shall meet all the requirements specified below.

b. Crushed Stone: Crushed stone shall consist of freshly mined quarry rock, and shall meet all the requirements specified below.

c. Crushed Recycled Concrete: Crushed recycled concrete shall consist of previously hardened portland cement concrete or other concrete containing pozzolanic binder material. The recycled material shall be free of all reinforcing steel, bituminous concrete surfacing, and any other foreign material and shall be crushed and processed to meet the required gradations for coarse aggregate. Crushed recycled concrete shall meet all other applicable requirements specified below.

d. Crushed Slag: Crushed slag shall be an air-cooled blast-furnace product having an air dry unit weight of not less than 1045 kg/cubic meter as determined by ASTM C 29/C 29M, and shall meet all the requirements specified below.

2.1.1.1 Aggregate Base Course

ABC coarse aggregate shall not show more than 50 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregates shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve listed in TABLE 1.

2.1.1.2 Graded-Crushed Aggregate Base Course

GCA coarse aggregate shall not show more than 40 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. GCA coarse aggregate shall not exhibit a loss greater than 40 percent weighted average, at five cycles, when tested for soundness in magnesium sulfate in accordance with ASTM C 88. The amount of flat and elongated particles shall not exceed 20 percent for the fraction retained on the 12.5 mm sieve nor 20 percent for the fraction passing the 12.5 mm sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3.

In the portion retained on each sieve specified, the crushed aggregate shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 90 percent of which by weight are retained on the maximum size sieve listed in TABLE 1.

2.1.2 Fine Aggregate

Fine aggregates shall be angular particles of uniform density. When the fine aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements.

2.1.2.1 Aggregate Base Course

ABC fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

2.1.2.2 Graded-Crushed Aggregate Base Course

GCA fine aggregate shall consist of angular particles produced by crushing stone, slag, recycled concrete, or gravel that meets the requirements for wear and soundness specified for GCA coarse aggregate.

2.1.3 Gradation Requirements

The specified gradation requirements shall apply to the completed base course. The aggregates shall have a maximum size of 2 mm and shall be continuously well graded within the limits specified in TABLE 1. Sieves shall conform to ASTM E 11.

TABLE 1. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3
-----	-----	-----	-----
50.0 mm	100	----	----
37.5 mm	70-100	100	----
25.0 mm	45-80	60-100	100
12.5 mm	30-60	30-65	40-70
4.75 mm	20-50	20-50	20-50
2.00 mm	15-40	15-40	15-40
0.425 mm	5-25	5-25	5-25
0.075 mm	0-8	0-8	0-8

NOTE 1: Particles having diameters less than 0.02 mm shall not be in excess of 3 percent by weight of the total sample tested.

NOTE 2: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, they shall be tested in accordance with ASTM C 127 and ASTM C 128 to determine their specific gravities. If the specific gravities vary by more than 10 percent, the percentages passing the various sieves shall be corrected as directed by the Contracting Officer.

2.1.4 Liquid Limit and Plasticity Index

Liquid limit and plasticity index requirements shall apply to the completed course and shall also apply to any component that is blended to meet the required gradation. The portion of any component or of the completed course passing the 0.425 mm sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the ABC or GCA is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF AGGREGATE SOURCES

Aggregates shall be obtained from offsite sources.

3.3 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.4 PREPARATION OF UNDERLYING COURSE

Prior to constructing the ABC and GCA, the underlying course or subgrade shall be cleaned of all foreign substances. At the time of construction of the ABC and GCA, the underlying course shall contain no frozen material. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. The underlying course shall conform to Section 02300 EARTHWORK. Ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses containing sands or gravels, as defined in ASTM D 2487, the surface shall be stabilized prior to placement of the ABC and GCA. Stabilization shall be accomplished by mixing ABC or GCA into the underlying course and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements of the underlying course.

The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the ABC and GCA is placed.

3.5 INSTALLATION

3.5.1 Mixing the Materials

The coarse and fine aggregates shall be mixed in a stationary plant, or in a traveling plant or bucket loader on an approved paved working area. The Contractor shall make adjustments in mixing procedures or in equipment as directed to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory ABC and GCA meeting all requirements of this specification.

3.5.2 Placing

The mixed material shall be placed on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. When a compacted layer 150 mm or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 150 mm is required, the material shall be placed in layers of equal thickness. No layer shall exceed 150 mm or less than 75mm when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the ABC and GCA

is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable ABC and GCA.

3.5.3 Grade Control

The finished and completed ABC and GCA shall conform to the lines, grades, and cross sections shown. Underlying material(s) shall be excavated and prepared at sufficient depth for the required ABC and GCA thickness so that the finished ABC and GCA with the subsequent surface course will meet the designated grades.

3.5.4 Edges of Base Course

The ABC and GCA shall be placed so that the completed section will be a minimum of 1.5 m wider, on all sides, than the next layer that will be placed above it. Additionally, approved fill material shall be placed along the outer edges of ABC and GCA in sufficient quantities to compact to the thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 600 mm width of this material to be rolled and compacted simultaneously with rolling and compacting of each layer of ABC and GCA. If this base course material is to be placed adjacent to another pavement section, then the layers for both of these sections shall be placed and compacted along this edge at the same time.

3.5.5 Compaction

Each layer of the ABC and GCA shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus 2 percent of the optimum water content determined from laboratory tests as specified in paragraph SAMPLING AND TESTING. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer has a degree of compaction that is at least 95 percent of laboratory maximum density through the full depth of the layer. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory ABC and GCA. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.5.6 Thickness

Compacted thickness of the aggregate course shall be as indicated. No individual layer shall exceed 150 mm nor be less than 75 mm in compacted

thickness. The total compacted thickness of the ABC and GCA course shall be within 13 mm of the thickness indicated. Where the measured thickness is more than 13 mm deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompact as directed. Where the measured thickness is more than 13 mm thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 6 mm of the thickness indicated. The total thickness of the ABC and GCA course shall be measured at intervals in such a manner as to ensure one measurement for each 250 square meters of base course. Measurements shall be made in 75 mm diameter test holes penetrating the base course.

3.5.7 Proof Rolling

Proof rolling of the areas indicated shall be in addition to the compaction specified and shall consist of the application of 30 coverages with a heavy pneumatic-tired roller having four or more tires, each loaded to a minimum of 13,600 kg and inflated to a minimum of 1035 kPa. In areas designated, proof rolling shall be applied to the top of the underlying material on which ABC and GCA is laid and to each layer of ABC and GCA. Water content of the underlying material shall be maintained at optimum or at the percentage directed from start of compaction to completion of proof rolling of that layer. Water content of each layer of the ABC and GCA shall be maintained at the optimum percentage directed from start of compaction to completion of proof rolling. Any ABC and GCA materials or any underlying materials that produce unsatisfactory results by proof rolling shall be removed and replaced with satisfactory materials, recompact and proof rolled to meet these specifications.

3.5.8 Finishing

The surface of the top layer of ABC and GCA shall be finished after final compaction and proof rolling by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of base course to meet grade. If the elevation of the top layer of ABC and GCA is 13 mm or more below grade, then the top layer should be scarified to a depth of at least 75 mm and new material shall be blended in compacted and proof rolled to bring to grade. Adjustments to rolling and finishing procedures shall be made as directed to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, reworked and recompact or it shall be replaced as directed.

3.5.9 Smoothness

The surface of the top layer shall show no deviations in excess of 10 mm when tested with a 3.05 meter straightedge. Measurements shall be taken in successive positions parallel to the centerline of the area to be paved.

Measurements shall also be taken perpendicular to the centerline at 15 meter intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing

material and compacting it to meet these specifications.

3.6 TRAFFIC

Completed portions of the ABC and GCA course may be opened to limited traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

3.7 MAINTENANCE

The ABC and GCA shall be maintained in a satisfactory condition until the full pavement section is completed and accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any ABC and GCA that is not paved over prior to the onset of winter, shall be retested to verify that it still complies with the requirements of this specification. Any area of ABC and GCA that is damaged shall be reworked or replaced as necessary to comply with this specification.

3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Any unsuitable materials that must be removed shall be disposed of as directed. No additional payments will be made for materials that must be replaced.

-- End of Section --

SECTION 03101A

FORMWORK FOR CONCRETE

09/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI 347 (2001) Guide to Formwork for Concrete

1.2 DESIGN REQUIREMENTS

The design, engineering, and construction of the formwork shall be the responsibility of the Contractor. The formwork shall be designed for anticipated live and dead loads and shall comply with the tolerances specified in Section 03307 CONCRETE FOR MINOR STRUCTURES, paragraph CONSTRUCTION TOLERANCES. However, for surfaces with an ACI Class A surface designation, the allowable deflection for facing material between studs, for studs between walers and walers between bracing shall be limited to 0.0025 times the span. The formwork shall be designed as a complete system with consideration given to the effects of cementitious materials and mixture additives such as fly ash, cement type, plasticizers, accelerators, retarders, air entrainment, and others. The adequacy of formwork design and construction shall be monitored prior to and during concrete placement as part of the Contractor's approved Quality Control Plan.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings

Drawings and design computations for all formwork required shall be submitted at least 30 days either before fabrication on site or before delivery of prefabricated forms. If reshoring is permitted, the method, including location, order, and time of erection and removal shall also be submitted for review.

SD-03 Product Data

Materials

Manufacturer's literature shall be submitted for plywood, concrete form hard board, form accessories, prefabricated forms, and form coating, and form-lining materials.

SD-04 Samples

Sample Panels; G; G

After shop drawings have been reviewed, sample panels for Class A finish with applied architectural treatment shall be built on the project site where directed.

SD-06 Test Reports

Inspection

The Contractor shall submit field inspection reports for concrete forms and embedded items.

Formwork Not Supporting Weight of Concrete; G.

If forms are to be removed in less than 24 hours on formwork not supporting the weight of concrete, the evaluation and results of the control cylinder tests or maturity instrumentation shall be submitted to and approved before the forms are removed.

1.4 SHOP DRAWINGS

The shop drawings and data submitted shall include the type, size, quantity, and strength of all materials of which the forms are made, the plan for jointing of facing panels, details affecting the appearance, and the assumed design values and loading conditions.

1.5 SAMPLE PANELS

Panels shall be of sufficient size to contain joints and shall be not less than 2 meters long and 1.5 meters wide. The panels shall be of typical wall thickness and constructed containing the full allocation of reinforcing steel that will be used in the structure, with the forming system that duplicates in every detail the one that will be used in construction of the structure. The same concrete mixture proportion and materials, the same placement techniques and equipment, and the same finishing techniques and timing shall be used that are planned for the structure. Construction of Class A finish will not be permitted until sample panels have been approved. Sample panels shall be protected from construction operations in a manner to protect approved finish, and are not to be removed until all Class A finish concrete has been accepted.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Forms and Form Liners

Forms and form liners shall be fabricated with facing materials that will produce a finish meeting the specified irregularities in formed surface requirements as defined in ACI 347. Forms and form liners shall be fabricated with facing materials as specified below.

2.1.1.1 Class "C" Finish

This class of finish shall apply to all exterior site applications. The form facing may be either tongue-and-groove lumber, plywood, concrete form hard board or steel. Wood form facing for curved or warped surfaces shall be composed of splines of lumber which can be bent to the required shape without splitting or cracking.

2.1.2 Form Coating

Form coating shall be commercial formulation that will not bond with, stain, cause deterioration, or any other damage to concrete surfaces. The coating shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds. If special form liners are to be used, the Contractor shall follow the recommendation of the form coating manufacturer.

2.2 ACCESSORIES

Ties and other similar form accessories to be partially or wholly embedded in the concrete shall be of a commercially manufactured type. After the ends or end fasteners have been removed, the embedded portion of metal ties shall terminate not less than 50 mm from any concrete surface either exposed to view or exposed to water. Plastic snap ties may be used in locations where the surface will not be exposed to view. Form ties shall be constructed so that the ends or end fasteners can be removed without spalling the concrete.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Form Construction

Forms shall be constructed true to the structural design and required alignment. The form surface and joints shall be mortar tight and supported to achieve safe performance during construction, concrete placement, and form removal. The Contractor shall continuously monitor the alignment and stability of the forms during all phases to assure the finished product will meet the required surface class or classes specified in paragraph FORMS AND FORM LINERS and tolerances specified in paragraph DESIGN REQUIREMENTS. Failure of any supporting surface either due to surface

texture, deflection or form collapse shall be the responsibility of the Contractor as will the replacement or correction of unsatisfactory surfaces. When forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be re-used if there is any evidence of defects which would impair the quality of the resulting concrete surface. All surfaces of used forms shall be cleaned of mortar and any other foreign material before reuse.

3.1.2 Chamfering

All exposed joints, edges and external corners shall be chamfered by molding placed in the forms unless the drawings specifically state that chamfering is to be omitted or as otherwise specified. Chamfered joints shall not be permitted where earth or rockfill is placed in contact with concrete surfaces. Chamfered joints shall be terminated 300 mm outside the limit of the earth or rockfill so that the end of the chamfers will be clearly visible.

3.1.3 Coating

Forms for exposed or painted surfaces shall be coated with form oil or a form-release agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's instructions. Forms for unexposed surfaces may be wet with water in lieu of coating immediately before placing concrete, except that, in cold weather when freezing temperatures are anticipated, coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.2 FORM REMOVAL

Forms shall not be removed without approval. The minimal time required for concrete to reach a strength adequate for removal of formwork without risking the safety of workers or the quality of the concrete depends on a number of factors including, but not limited to, ambient temperature, concrete lift heights, type and amount of concrete admixture, and type and amount of cementitious material in the concrete. It is the responsibility of the Contractor to consider all applicable factors and leave the forms in place until it is safe to remove them.

3.2.1 Formwork Not Supporting Weight of Concrete

Formwork for walls, columns, sides of beams, gravity structures, and other vertical type formwork not supporting the weight of concrete shall not be removed in less than 24 hours after concrete placement is completed. Form removal before 24 hours will be allowed for simple floor slab, sidewalks, and driveways provided the ambient temperature during this period has not fallen below 10 degrees C at any time since placement and evidence from compressive tests on field-cured concrete control cylinders indicates that the concrete has attained the required compressive strength following the initial 24-hour period. Control cylinders shall be prepared for each set of forms to be removed before 24 hours. The stability of the concrete

shall be evaluated by a structural engineer prior to removal of the forms.

3.2.2 Formwork Supporting Weight of Concrete

Formwork supporting weight of concrete and shoring shall not be removed until structural members have acquired sufficient strength to safely support their own weight and any construction or other superimposed loads to which the supported concrete may be subjected. As a minimum, forms shall be left in place until control concrete test cylinders or maturity instrumentation indicate evidence the concrete has attained at least 70 percent of the compressive strength required for the structure.

3.3 INSPECTION

Forms and embedded items shall be inspected in sufficient time prior to each concrete placement by the Contractor in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

-- End of Section --

SECTION 03200A

CONCRETE REINFORCEMENT
02/04

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI 318M/318RM (2002) Metric Building Code Requirements
for Structural Concrete and Commentary

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4 (1998) Structural Welding Code -
Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 184/A 184M (2001) Fabricated Deformed Steel Bar Mats
for Concrete Reinforcement

ASTM A 185 (2002) Steel Welded Wire Reinforcement,
Plain, for Concrete

ASTM A 53 (1999b) Pipe, Steel, Black and Hot-Dipped,
Zinc-Coated, Welded and Seamless

ASTM A 615/A 615M (2003a) Deformed and Plain Billet-Steel
Bars for Concrete Reinforcement

ASTM A 675/A 675M (1990a; R 2000) Steel Bars, Carbon,
Hot-Wrought, Special Quality, Mechanical
Properties

ASTM A 706/A 706M (2003) Low-Alloy Steel Deformed and Plain
Bars for Concrete Reinforcement

ASTM A 767/A 767M (2000b) Zinc-Coated (Galvanized) Steel
Bars for Concrete Reinforcement

ASTM A 775/A 775M (2001) Epoxy-Coated Reinforcing Steel Bars

ASTM A 82 (2002) Steel Wire, Plain, for Concrete
Reinforcement

ASTM A 884/A 884M

(2002) Epoxy-Coated Steel Wire and Welded
Wire Fabric for Reinforcement

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 1MSP

(2001) Manual of Standard Practice

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Reinforcement; G, AE

Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

SD-03 Product Data

Welding

A list of qualified welders names.

SD-07 Certificates

Reinforcing Steel

Certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

1.3 WELDING

Welders shall be qualified in accordance with AWS D1.4. Qualification test shall be performed at the worksite and the Contractor shall notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4.

1.4 DELIVERY AND STORAGE

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 DOWELS

Dowels shall conform to ASTM A 675/A 675M, Grade 80. Steel pipe conforming to ASTM A 53, Schedule 80, may be used as dowels provided the ends are closed with metal or plastic inserts or with mortar.

2.2 FABRICATED BAR MATS

Fabricated bar mats shall conform to ASTM A 184/A 184M.

2.3 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M or ASTM A 706/A 706M, grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 82. In highly corrosive environments or when directed by the Contracting Officer, reinforcing steel shall conform to ASTM A 767/A 767M or ASTM A 775/A 775M as appropriate.

2.4 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185. When directed by the Contracting Officer for special applications, welded wire fabric shall conform to ASTM A 884/A 884M.

2.5 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.6 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI 1MSP and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 100 by 100 mm when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 13 mm of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

PART 3 EXECUTION

3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318M/318RM. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete

reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete.

Reinforcement shall be placed in accordance with ACI 318M/318RM at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318M/318RM. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318M/318RM and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Welding shall conform to AWS D1.4. Welded butt splices shall be full penetration butt welds. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 150 mm. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 50 mm. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 1.2 m. Fabric shall be positioned by the use of supports.

3.3 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

-- End of Section --

SECTION 03307A

CONCRETE FOR MINOR STRUCTURES

11/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI 318M/318RM (2002) Metric Building Code Requirements for Structural Concrete and Commentary

ACI 347R (2001) Guide to Formwork for Concrete

ASTM INTERNATIONAL (ASTM)

ASTM A 185 (2002) Steel Welded Wire Reinforcement, Plain, for Concrete

ASTM A 615/A 615M (2003a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM C 143/C 143M (2003) Slump of Hydraulic Cement Concrete

ASTM C 150 (2002a) Portland Cement

ASTM C 171 (2003) Sheet Materials for Curing Concrete

ASTM C 172 (1999) Sampling Freshly Mixed Concrete

ASTM C 231 (2003) Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C 260 (2001) Air-Entraining Admixtures for Concrete

ASTM C 309 (2003) Liquid Membrane-Forming Compounds for Curing Concrete

ASTM C 31/C 31M (2003a) Making and Curing Concrete Test Specimens in the Field

ASTM C 33 (2003) Concrete Aggregates

ASTM C 39/C 39M (2003) Compressive Strength of Cylindrical

Concrete Specimens

ASTM C 494/C 494M	(1999ae1) Chemical Admixtures for Concrete
ASTM C 618	(2003) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 685	(2000) Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C 94/C 94M	(2003a) Ready-Mixed Concrete
ASTM D 75	(2003) Sampling Aggregates
ASTM E 96	(2000e1) Water Vapor Transmission of Materials

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Air-Entraining Admixture; G, AE
Accelerating Admixture; G, AE
Water-Reducing or Retarding Admixture; G, AE
Curing Materials; G, AE
Reinforcing Steel; G, AE

Manufacturer's literature is available from suppliers which demonstrates compliance with applicable specifications for the above materials.

Batching and Mixing Equipment; G

Batching and mixing equipment will be accepted on the basis of manufacturer's data which demonstrates compliance with the applicable specifications.

Conveying and Placing Concrete; G

The methods and equipment for transporting, handling,

depositing, and consolidating the concrete shall be submitted prior to the first concrete placement.

Formwork; G

Formwork design shall be submitted prior to the first concrete placement.

SD-06 Test Reports

Aggregates; G, AE

Aggregates will be accepted on the basis of certificates of compliance and test reports that show the material(s) meets the quality and grading requirements of the specifications under which it is furnished.

Concrete Mixture Proportions; G, AE

Ten days prior to placement of concrete, the contractor shall submit the mixture proportions that will produce concrete of the quality required. Applicable test reports shall be submitted to verify that the concrete mixture proportions selected will produce concrete of the quality specified.

SD-07 Certificates

Cementitious Materials; G, AE

Certificates of compliance attesting that the concrete materials meet the requirements of the specifications shall be submitted in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Cementitious material will be accepted on the basis of a manufacturer's certificate of compliance, accompanied by mill test reports that the material(s) meet the requirements of the specification under which it is furnished.

Aggregates; G, AE

Aggregates will be accepted on the basis of certificates of compliance and tests reports that show the material(s) meet the quality and grading requirements of the specifications under which it is furnished.

1.3 UNIT PRICES

1.3.1 Concrete

1.3.1.1 Payment

All costs associated with manufacturing, furnishing, delivering, placing, finishing, and curing of concrete for the various items of the schedule, which price shall include the cost of all formwork. Payment for concrete for which payment is made as a lump sum is to be included in this unit

price payment item. Payment for grout, preformed expansion joints, field-molded sealants, waterstops, reinforcing steel bars or wire reinforcement is to be included in this unit price payment item.

1.3.1.2 Measurement

Concrete will be measured for payment on the basis of the actual volume of concrete within the pay lines of the structures as indicated. Measurement of concrete placed against the sides of any excavation without the use of intervening forms will be made only within the pay lines of the structure. No deductions will be made for rounded or beveled edge, for space occupied by meal work, for electrical conduits or timber, or for voids or embedded items that are either less than 0.14 cubic meter in volume or 0.1 square meter in cross section.

1.3.1.3 Unit of Measure

Unit of measure: cubic meter.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

The Government will maintain the option to sample and test joint sealer, joint filler material, waterstop, aggregates and concrete to determine compliance with the specifications. The Contractor shall provide facilities and labor as may be necessary to assist the Government in procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Concrete will be sampled in accordance with ASTM C 172. Slump and air content will be determined in accordance with ASTM C 143/C 143M and ASTM C 231, respectively, when cylinders are molded. Compression test specimens will be made, cured, and transported in accordance with ASTM C 31/C 31M. Compression test specimens will be tested in accordance with ASTM C 39/C 39M.

Samples for strength tests will be taken not less than once each shift in which concrete is produced from each class of concrete required. A minimum of three specimens will be made from each sample; two will be tested at 28 days (90 days if pozzolan is used) for acceptance, and one will be tested at 7 days for information.

1.4.1 Strength

Acceptance test results will be the average strengths of two specimens tested at 28 days (90 days if pozzolan is used). The strength of the concrete will be considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength, f'_c , and no individual acceptance test result falls below f'_c by more than 3.4 MPa.

1.4.2 Construction Tolerances

A Class "C" finish shall apply to all surfaces except those specified to receive a Class "D" finish. A Class "D" finish shall apply to all surfaces which will be permanently concealed after construction. The surface requirements for the classes of finish required shall be as specified in ACI 347R.

1.4.3 Concrete Mixture Proportions

Concrete mixture proportions shall be the responsibility of the Contractor.

Mixture proportions shall include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per cubic yard of concrete. All materials included in the mixture proportions shall be of the same type and from the same source as will be used on the project. Specified compressive strength f'_c shall be 27.6 MPa at 28 days (90 days if pozzolan is used). The maximum nominal size coarse aggregate shall be 37.5 mm, in accordance with ACI 318M/318RM. The air content shall be between 5 and 8 percent. The slump shall not exceed 100 mm. The maximum water cement ratio shall be 0.45.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Cementitious Materials

Cementitious materials shall conform to the appropriate specifications listed:

2.1.1.1 Portland Cement

ASTM C 150, Type IIIA, except that the tricalcium aluminate of the Type III or IIIA cement shall be limited to 5 percent.

2.1.1.2 Pozzolan

Pozzolan shall conform to ASTM C 618, Class C or F, including requirements of Tables 1A and 2A.

2.1.2 Aggregates

Aggregates shall meet the quality and grading requirements of ASTM C 33 Class Designations 4M or better.

2.1.3 Admixtures

Admixtures to be used, when required or approved, shall comply with the appropriate specification listed. Chemical admixtures that have been in storage at the project site for longer than 6 months or that have been subjected to freezing shall be retested at the expense of the contractor at the request of the Contracting Officer and shall be rejected if test results are not satisfactory.

2.1.3.1 Air-Entraining Admixture

Air-entraining admixture shall meet the requirements of ASTM C 260.

2.1.3.2 Accelerating Admixture

Other accelerators shall meet the requirements of ASTM C 494/C 494M, Type C or E.

2.1.3.3 Water-Reducing or Retarding Admixture

Water-reducing or retarding admixture shall meet the requirements of ASTM C 494/C 494M, Type A, B, or D. High-range water reducing admixture Type F or G may be used only when approved, approval being contingent upon particular placement requirements as described in the Contractor's Quality Control Plan.

2.1.4 Water

Water for mixing and curing shall be fresh, clean, potable, and free from injurious amounts of oil, acid, salt, or alkali, except that unpotable water may be used if it meets the requirements of COE CRD-C 400.

2.1.5 Reinforcing Steel

Reinforcing steel bar shall conform to the requirements of ASTM A 615/A 615M, Grade 420. Welded steel wire fabric shall conform to the requirements of ASTM A 185. Details of reinforcement not shown shall be in accordance with ACI 318M/318RM, Chapters 7 and 12.

2.1.6 Formwork

The design and engineering of the formwork as well as its construction, shall be the responsibility of the Contractor.

2.1.7 Form Coatings

Forms for exposed surfaces shall be coated with a nonstaining form oil, which shall be applied shortly before concrete is placed.

2.1.8 Vapor Barrier

Vapor barrier shall be polyethylene sheeting with a minimum thickness of 0.15 mm or other equivalent material having a vapor permeance rating not exceeding 30 nanograms per pascal second square meter as determined in accordance with ASTM E 96.

2.1.9 Curing Materials

Curing materials shall conform to the following requirements.

2.1.9.1 Impervious Sheet Materials

Impervious sheet materials, ASTM C 171, type optional, except polyethylene film, if used, shall be white opaque.

2.1.9.2 Membrane-Forming Curing Compound

ASTM C 309, Type 1-D or 2, Class B.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 General

Construction joints shall be prepared to expose coarse aggregate, and the surface shall be clean, damp, and free of laitance. Ramps and walkways, as necessary, shall be constructed to allow safe and expeditious access for concrete and workmen. Snow, ice, standing or flowing water, loose particles, debris, and foreign matter shall have been removed. Earth foundations shall be satisfactorily compacted. Spare vibrators shall be available. The entire preparation shall be accepted by the Government prior to placing.

3.1.2 Embedded Items

Reinforcement shall be secured in place; joints, anchors, and other embedded items shall have been positioned. Internal ties shall be arranged so that when the forms are removed the metal part of the tie will be not less than 50 mm from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Embedded items shall be free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. All equipment needed to place, consolidate, protect, and cure the concrete shall be at the placement site and in good operating condition.

3.1.3 Formwork Installation

Forms shall be properly aligned, adequately supported, and mortar-tight. The form surfaces shall be smooth and free from irregularities, dents, sags, or holes when used for permanently exposed faces. All exposed joints and edges shall be chamfered, unless otherwise indicated.

3.1.4 Production of Concrete

3.1.4.1 Ready-Mixed Concrete

Ready-mixed concrete shall conform to ASTM C 94/C 94M except as otherwise specified.

3.1.4.2 Concrete Made by Volumetric Batching and Continuous Mixing

Concrete made by volumetric batching and continuous mixing shall conform to ASTM C 685.

3.1.4.3 Batching and Mixing Equipment

The contractor shall have the option of using an on-site batching and

mixing facility. The facility shall provide sufficient batching and mixing equipment capacity to prevent cold joints. The method of measuring materials, batching operation, and mixer shall be submitted for review. On-site plant shall conform to the requirements of either ASTM C 94/C 94M or ASTM C 685.

3.2 CONVEYING AND PLACING CONCRETE

Conveying and placing concrete shall conform to the following requirements.

3.2.1 General

Concrete placement shall not be permitted when weather conditions prevent proper placement and consolidation without approval. When concrete is mixed and/or transported by a truck mixer, the concrete shall be delivered to the site of the work and discharge shall be completed within 1-1/2 hours.

Concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods which prevent segregation or loss of ingredients. Concrete shall be in place and consolidated within 15 minutes after discharge from the mixer. Concrete shall be deposited as close as possible to its final position in the forms and be so regulated that it may be effectively consolidated in horizontal layers 450 mm or less in thickness with a minimum of lateral movement. The placement shall be carried on at such a rate that the formation of cold joints will be prevented.

3.2.2 Consolidation

Each layer of concrete shall be consolidated by rodding, spading, or internal vibrating equipment. External vibrating equipment may be used when authorized. Internal vibration shall be systematically accomplished by inserting the vibrator through the fresh concrete in the layer below at a uniform spacing over the entire area of placement. The distance between insertions shall be approximately 1.5 times the radius of action of the vibrator and overlay the adjacent, just-vibrated area by approximately 100 mm. The vibrator shall penetrate rapidly to the bottom of the layer and at least 150 mm into the layer below, if such a layer exists. It shall be held stationary until the concrete is consolidated and then withdrawn slowly at the rate of about 75 mm per second.

3.2.3 Cold-Weather Requirements

No concrete placement shall be made when the ambient temperature is below 2 degrees C or if the ambient temperature is below 5 degrees C and falling. Suitable covering and other means as approved shall be provided for maintaining the concrete at a temperature of at least 10 degrees C for not less than 72 hours after placing and at a temperature above freezing for the remainder of the curing period. Salt, chemicals, or other foreign materials shall not be mixed with the concrete to prevent freezing. Any concrete damaged by freezing shall be removed and replaced at the expense of the contractor.

3.3 FORM REMOVAL

Forms shall not be removed before the expiration of 24 hours after concrete

placement except where otherwise specifically authorized. Supporting forms and shoring shall not be removed until the concrete has cured for at least 5 days. When conditions on the work are such as to justify the requirement, forms will be required to remain in place for longer periods.

3.4 FINISHING

3.4.1 General

No finishing or repair will be done when either the concrete or the ambient temperature is below 10 degrees C.

3.4.2 Finishing Formed Surfaces

All fins and loose materials shall be removed, and surface defects including tie holes shall be filled. All honeycomb areas and other defects shall be repaired. All unsound concrete shall be removed from areas to be repaired. Surface defects greater than 13 mm in diameter and holes left by removal of tie rods in all surfaces not to receive additional concrete shall be reamed or chipped and filled with dry-pack mortar. The prepared area shall be brush-coated with an approved epoxy resin or latex bonding compound or with a neat cement grout after dampening and filled with mortar or concrete. The cement used in mortar or concrete for repairs to all surfaces permanently exposed to view shall be a blend of portland cement and white cement so that the final color when cured will be the same as adjacent concrete.

3.4.3 Finishing Unformed Surfaces

All unformed surfaces that are not to be covered by additional concrete or backfill shall be float finished to elevations shown, unless otherwise specified. Surfaces to receive additional concrete or backfill shall be brought to the elevations shown and left as a true and regular surface. Exterior surfaces shall be sloped for drainage unless otherwise shown. Joints shall be carefully made with a jointing tool. Unformed surfaces shall be finished to a tolerance of 10 mm for a float finish and 8 mm for a trowel finish as determined by a 3 m straightedge placed on surfaces shown on the plans to be level or having a constant slope. Finishing shall not be performed while there is excess moisture or bleeding water on the surface. No water or cement shall be added to the surface during finishing.

3.4.3.1 Float Finish

Surfaces to be float finished shall be screeded and darbyed or bullfloated to eliminate the ridges and to fill in the voids left by the screed. In addition, the darby or bullfloat shall fill all surface voids and only slightly embed the coarse aggregate below the surface of the fresh concrete. When the water sheen disappears and the concrete will support a person's weight without deep imprint, floating should be completed. Floating should embed large aggregates just beneath the surface, remove slight imperfections, humps, and voids to produce a plane surface, compact the concrete, and consolidate mortar at the surface.

3.4.3.2 Broom Finish

A broom finish shall be applied to exterior slabs and pads. The concrete shall be screeded and floated to required finish plane with no coarse aggregate visible. After surface moisture disappears, the surface shall be broomed or brushed with a broom or fiber bristle brush in a direction transverse to that of the main traffic or as directed.

3.5 CURING AND PROTECTION

Beginning immediately after placement and continuing for at least 7 days, except for concrete made with Type III cement, at least 3 days, all concrete shall be cured and protected from premature drying, extremes in temperature, rapid temperature change, freezing, mechanical damage, and exposure to rain or flowing water. All materials and equipment needed for adequate curing and protection shall be available and at the site of the placement prior to the start of concrete placement. Preservation of moisture for concrete surfaces not in contact with forms shall be accomplished by one of the following methods:

- a. Continuous sprinkling or ponding.
- b. Application of absorptive mats or fabrics kept continuously wet.
- c. Application of sand kept continuously wet.
- d. Application of impervious sheet material conforming to ASTM C 171.
- e. Application of membrane-forming curing compound conforming to ASTM C 309, Type 1-D, on surfaces permanently exposed to view and Type 2 on other surfaces shall be accomplished in accordance with manufacturer's instructions.

The preservation of moisture for concrete surfaces placed against wooden forms shall be accomplished by keeping the forms continuously wet for 7 days, except for concrete made with Type III cement, 3 days. If forms are removed prior to end of the required curing period, other curing methods shall be used for the balance of the curing period. During the period of protection removal, the temperature of the air in contact with the concrete shall not be allowed to drop more than 15 degrees C within a 24 hour period.

3.6 TESTS AND INSPECTIONS

3.6.1 General

The individuals who sample and test concrete as required in this specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

3.6.2 Inspection Details and Frequency of Testing

3.6.2.1 Preparations for Placing

Foundation or construction joints, forms, and embedded items shall be inspected in sufficient time prior to each concrete placement by the Contractor to certify that it is ready to receive concrete.

3.6.2.2 Air Content

Air content shall be checked at least once during each shift that concrete is placed for each class of concrete required. Samples shall be obtained in accordance with ASTM C 172 and tested in accordance with ASTM C 231.

3.6.2.3 Slump

Slump shall be checked once during each shift that concrete is produced for each class of concrete required. Samples shall be obtained in accordance with ASTM C 172 and tested in accordance with ASTM C 143/C 143M.

3.6.2.4 Consolidation and Protection

The Contractor shall ensure that the concrete is properly consolidated, finished, protected, and cured.

3.6.3 Action Required

3.6.3.1 Placing

The placing foreman shall not permit placing to begin until he has verified that an adequate number of acceptable vibrators, which are in working order and have competent operators, are available. Placing shall not be continued if any pile is inadequately consolidated.

3.6.3.2 Air Content

Whenever a test result is outside the specification limits, the concrete shall not be delivered to the forms and an adjustment shall be made to the dosage of the air-entrainment admixture.

3.6.3.3 Slump

Whenever a test result is outside the specification limits, the concrete shall not be delivered to the forms and an adjustment should be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the water-cement ratio does not exceed that specified in the submitted concrete mixture proportion.

3.6.4 Reports

The results of all tests and inspections conducted at the project site shall be reported informally at the end of each shift and in writing weekly and shall be delivered within 3 days after the end of each weekly reporting period. See Section 01451A CONTRACTOR QUALITY CONTROL.

-- End of Section --

SECTION 03410A

PRECAST/PRESTRESSED CONCRETE FLOOR AND ROOF UNITS

02/04

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI 318M/318RM (2002) Metric Building Code Requirements
for Structural Concrete and Commentary

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2002) Structural Welding Code - Steel

PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)

PCI MNL-116 (1999) Quality Control for Plants and
Production of Structural Precast Concrete
Products

PCI MNL-120 (1999) Design Handbook - Precast and
Prestressed Concrete

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Precast/Prestressed Units; G, AE

Detail drawings shall consist of erection instructions and the following as applicable:

- a. Anchorage for work of other trades.
- b. Anchorage to supporting construction, if required by the design.

c. Headers for openings where additional structural work is required.

d. Joints between units and other construction.

e. Reinforcing including prestressing steel details.

f. Pick-up points for handling units.

g. Minimum concrete compressive strengths at initial prestress and 28 days, initial prestress to be applied, and minimum release strength.

h. Shoring, unless structural computations are submitted showing that allowable concrete stresses during the work will not be exceeded when shoring is not used.

i. Layout plan and member identification marks.

SD-03 Product Data

Precast/Prestressed Units

Complete design analysis and load charts signed by a professional engineer and in booklet form for the units to be furnished. Analysis shall include mixture proportion; concrete strength; stress calculations; complete camber calculation showing initial camber, estimated long term camber, and anticipated long term camber and deflection. Design analysis shall indicate which code the design was based on.

SD-06 Test Reports

Tests

Certified copies of test reports including all data and results of tests performed as required by PCI MNL-116.

1.3 GENERAL REQUIREMENTS

Precast/prestressed units shall be produced under plant-controlled conditions conforming to PCI MNL-116 by a firm certified under the PCI Plant Certification Program and specializing in providing precast/prestressed concrete floor and roof units and related services.

1.4 DESIGN

Design of units shall be performed by structural analysis in accordance with ACI 318M/318RM or PCI MNL-120 whichever is customary with the fabricator. Structural analysis shall include evaluations of the effects of connections, holes, discontinuities, concentrated loads, and joints. Units shall be designed for the load conditions and spans indicated and any additional loads imposed by openings; work of other trades; concrete topping indicated; and all loading and restraining conditions from

fabrication, handling, and erection. The sum of the immediate deflection due to live load and additional long-term deflection shall not exceed the deflection limitations indicated. The design shall compensate for the weight of the additional topping required by the camber in order to achieve the minimum topping thickness used in the design.

1.5 HANDLING AND STORAGE

Units shall be cured prior to delivery to the jobsite. Units shall be stored off the ground and protected from soilage, marring, damage, or overload. Stacked members shall be separated by battens across the full width at bearing points.

PART 2 PRODUCTS

2.1 FABRICATION

Fabrication of the units shall be in accordance with the requirements of PCI MNL-116. Units shall be made available for inspection by the Contracting Officer at the manufacturer's plant. Shape of units shall be hollow-core slabs as indicated. Unit spans shall be as shown. Units shall be fabricated within the dimensional tolerances given in PCI MNL-116. Inserts, anchor bolts, bearing plates, and other embedded items shall be located as required or indicated. Where required, units shall be marked to facilitate sequential erection. Openings for mechanical and utility systems and for architectural purpose shall be as shown. Prestressing eccentricity and force applied shall be adjusted to the extent possible so that the camber provided is the minimum amount needed to produce an approximate level slab after dead loads are applied. Surfaces that will be concealed from view shall be free of surface holes over 13 mm in diameter. Surfaces to receive subsequent applications other than painting shall be suitable for the purpose intended and free of any coatings that would interfere with adhesion or bond. Surfaces that will be painted or exposed to view shall be smooth, free of form marks, and shall have surface blemishes filled and finished to match adjoining concrete in color and texture. Top surfaces which are to receive concrete topping shall be roughened to a full amplitude of approximately 6 mm.

2.2 TESTS

Tests, as required by PCI MNL-116, shall be performed by an independent testing laboratory or in the manufacturer's approved laboratory if the manufacturer has a PCI certified plant with proof of current certification.

PART 3 EXECUTION

3.1 ERECTION

Erection shall be in accordance with the approved detail drawings. Field welding shall be in accordance with AWS D1.1/D1.1M. Installation of equipment required by other trades shall be accomplished as the work progresses if required by design. Field-cut openings for utilities penetrations will not be permitted unless recommended by the manufacturer and approved by the Contracting Officer. Bearing surfaces shall be level

and free from irregularities. Irregularities in masonry bearing surfaces shall be leveled as recommended by the manufacturer or with a stiff cement grout. Grout shall be allowed to harden before installing the units. Units shall be installed at right angles to bearings, drawn up tight without forcing or distortion, and with sides plumb. Slab ends shall be aligned. Underside of slabs shall present true ceiling surface when the ceiling is exposed to view. Where shown on approved detail drawings, the keyways between units and other spaces shall be cleaned and filled solid with grout. Grout that may have seeped through to surfaces in spaces below shall be removed before hardening. Joints in ceilings that will be exposed to view or painted shall be caulked as specified in Section 07920 JOINT SEALANTS. Erected units shall be temporarily covered until finish roofing is applied.

3.2 CONCRETE TOPPING

Concrete topping reinforced with welded wire fabric shall be applied to tops of units continuous over the entire span. Welded wire fabric of the size indicated shall be as specified in Section 03200A CONCRETE REINFORCEMENT. Tops of units shall be clean and free of any material that would reduce adhesion or bond. The concrete topping shall be a minimum of 50 mm thick of 21 MPa minimum compressive strength at 28 days. Concrete materials, quality, placing, curing, and finishing shall be as specified in Section 03307A CONCRETE FOR MINOR STRUCTURES.

-- End of Section --

SECTION 03415A

PRECAST-PRESTRESSED CONCRETE

09/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 214R	(2002) Evaluation of Strength Test Results of Concrete
ACI 318M/318RM	(2002) Metric Building Code Requirements for Structural Concrete and Commentary

ASTM INTERNATIONAL (ASTM)

ASTM C 150	(2002a _{el}) Portland Cement
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 231	(2003) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2001) Air-Entraining Admixtures for Concrete
ASTM C 31/C 31M	(2003a) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(2003) Concrete Aggregates
ASTM C 39/C 39M	(2003) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 494/C 494M	(1999a _{el}) Chemical Admixtures for Concrete
ASTM C 618	(2003) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete

PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)

PCI MNL-116	(1999) Quality Control for Plants and Production of Structural Precast Concrete Products
PCI MNL-120	(1999) Design Handbook - Precast and Prestressed Concrete

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Erection; G, AE

The Contractor shall prepare and submit for approval complete shop drawings that show the precast unit manufacturer's recommended details and materials for the work required by paragraphs DELIVERY, STORAGE, AND HANDLING and ERECTION. The shop drawings shall include: design computations; marking of the units for the placing drawings; anchorages for work of other trades; anchorages to support construction; size and location of steel tendons; methods of stressing; location and sizes of all openings 300 mm wide or larger to be cast into members; formwork; joints between units and other construction; reinforcing steel details; method of curing; and, pickup points and lifting devices.

SD-03 Product Data

Erection Plan; G, AE

The Contractor shall prepare a detailed erection plan which shall be submitted at least 15 days prior to the date that erection of members is to begin.

Design Calculations; G, AE

Design calculations shall be submitted prior to the initiation of manufacture of members to be used under this contract.

Concrete Mixture Proportions; G, AE

Concrete mixture proportions shall be submitted for approval.

Construction Records; G

Construction records of the manufacturing, handling, and erection of the precast prestressed concrete members shall be

submitted.

SD-06 Test Reports

Materials; G

Certified test reports of required material tests shall be submitted prior to the use of the materials in the work. Reports shall be furnished for each shipment and shall be identified with specific lots.

Concrete; G

The results of concrete strength testing by the contractor shall be submitted not more than 5 days after the tests are completed.

SD-07 Certificates

Cement; G, AE

Pozzolan; G, AE

Air-Entraining Admixture; G, AE

Water-Reducing Admixture; G, AE

Accelerating Admixture; G, AE

Aggregates; G, AE

Cement, Pozzolan, Air-Entraining Admixture, Water-Reducing Admixture, Accelerating Admixture, and Aggregates shall be certified for compliance with all specifications requirements.

Air Content; G, AE

Each precast member delivered to the jobsite shall be accompanied by a certificate certifying that the air content in the concrete in that member is in compliance with the specifications. The certification must be based on an air content test conducted in conformance with ASTM C 231 on at least one of the batches of concrete from which the member was cast.

1.3 SYSTEM DESCRIPTION

1.3.1 Design Requirements

1.3.1.1 Precast-Prestressed Members and Connections

Design of members and connections shall be in accordance with ACI 318M/318RM and PCI MNL-120.

1.3.1.2 Loads

Loadings for members and connections shall include all dead load, live load, applicable lateral loads such as wind and earthquake, applicable construction loads such as handling, erection loads, and other applicable loads.

1.3.1.3 Design Calculations

Design calculations for members and connections not shown in the contract drawings shall be made by a registered professional engineer experienced in the design of precast concrete.

1.3.2 Performance Requirements

Perform the following testing to ensure the materials and method used meet the requirements of these specifications and will produce precast concrete members which are suitable for their intended use.

1.3.2.1 Concrete

Concrete shall be sampled and cylinders made in accordance with ASTM C 172 and ASTM C 31/C 31M.

a. Concrete Test Cylinders. A minimum of three concrete test cylinders per bed shall be made to verify the strength of concrete at the time of stress transfer and a minimum of two test cylinders per day or 38 cubic meters of concrete or fraction thereof, whichever results in the most cylinders, shall be made for each mix design to verify the attainment of the specified strength.

b. Cylinder Making. Cylinders shall be made as near as possible to the location where they will be cured and shall not be disturbed in any way from 1/2 hour after casting until they are either 24 hours old or ready to be tested. Concrete in cylinders may be consolidated by rodding or by vibration as specified in ASTM C 31/C 31M.

c. Cylinder Curing

(1) Test cylinders shall be cured with similar methods as the members they represent. In lieu of actual curing with the members, cylinders may be cured in curing chambers correlated in temperature and humidity with the beds. In such a case, the correlation shall be constantly verified by use of recording thermometers in the curing chambers and comparison with the temperature records of beds and by use of the same methods of moisture retention for curing chambers and casting beds.

(2) For beds cured by steam or radiant heat, cylinders shall be placed at random points along the bed. If there is any indication of variable heat, cylinders shall be placed in the coolest area.

(3) Test cylinders to indicate compliance with specified 28-day or earlier strength shall remain in the bed with the member until the member is removed. At that time, the cylinders shall be removed from their molds and placed in storage in a moist condition at 23 degrees plus or minus 1.5 degrees C.

d. Testing of Cylinders

(1) Testing of cylinders to determine compressive strength shall

be performed in accordance with ASTM C 39/C 39M. The strength of concrete at any given age shall be determined as the average of two cylinders, except a single cylinder test can be used to determine stress transfer strength or predictive strengths at less than 28 days.

(2) Testing machines shall be calibrated in accordance with ASTM C 39/C 39M.

1.3.2.2 Air Content

The air content tests shall be conducted in accordance with ASTM C 231. At least one air content test shall be conducted on the concrete from which each member is cast.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Transportation

1.4.1.1 Transporting Members

In transporting members by truck, railroad car, or barge, provision shall be made for supporting the members as described above, except battens can be continuous over more than one stack of units, with adequate bracing to ensure their maintaining the vertical position and damping of dangerous vibrations. Trucks with double bolsters are satisfactory provided the members are fully seated on the outer bolsters at not more than 1 m or the depth of the member from the end and the inner bolster is not more than 2.3 m from the end of the member or the designated pickup point. Adequate padding material shall be provided between tie chains or cables to preclude chipping of concrete.

1.4.1.2 Lateral Deflection or Vibration

Any noticeable indication of lateral deflection or vibration during transportation shall be corrected by rigid bracing between members or by means of lateral trussing.

1.4.2 Storage

1.4.2.1 Storage Areas

Storage areas for precast members shall be stabilized, and suitable foundations shall be provided, so differential settlement or twisting of members will not occur.

1.4.2.2 Stacked members

Stacked members shall be separated and supported by battens placed across the full width of each bearing point. Battens shall be arranged in vertical planes at a distance not greater than the depth of the member from designated pickup points. Battens shall not be continuous over more than one stack of precast units. Stacking of members shall be such that lifting devices will be accessible and undamaged. The upper members of a stacked

tier shall not be used as storage areas for shorter members or equipment.

1.4.3 Handling of Members

The location of pickup points for handling of the members and details of the pickup devices shall be shown in shop drawings. Members shall be handled only by means of approved devices at designated locations. Members shall be maintained in an upright position at all times and picked up and supported as shown in approved shop drawings.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall comply with the following:

2.1.1 Cement

Cement shall comply with the following:

2.1.1.1 Portland Cement

Portland cement shall conform to ASTM C 150, Type IIIA. The tricalcium aluminate content of the Type III cement shall be limited to 5 percent.

2.1.2 Pozzolan

Pozzolan shall conform to ASTM C 618 Class F or C.

2.1.3 Other Materials

2.1.3.1 Aggregates

Aggregates shall meet the requirements of ASTM C 33.

2.1.3.2 Admixtures

In no event shall admixtures containing chlorides or nitrates be used in the concrete.

a. Air-entraining admixture shall be certified to comply with ASTM C 260.

b. Water-reducing admixture shall be certified to comply with ASTM C 494/C 494M Type A.

c. Accelerating admixture shall be certified to comply with ASTM C 494/C 494M Type C.

2.1.4 Steel Reinforcement

Steel reinforcement shall be in accordance with Section 03200A CONCRETE REINFORCEMENT.

2.2 CONCRETE MIXTURE PROPORTIONS

2.2.1 Concrete

Concrete shall be composed of cementitious material, water, fine and coarse aggregate, and admixtures. The cementitious material shall be portland or blended hydraulic cement and pozzolan where appropriate. The admixtures shall be an air-entraining agent and may include a water-reducing admixture when its formulation and use are approved.

2.2.2 Proportions

The concrete mixture proportions shall meet the following requirements:

Maximum Water-cement ratio (w/c) = 0.45.
Specified Strength = 27.6 MPa at 28 days.

Air Content = 5 to 7 percent as determined in accordance with ASTM C 231. Proportions shall be selected so that the maximum permitted w/c ratio is not exceeded and so as to produce an average strength exceeding the design strength f'_c by the amount indicated below. Where the production facility has a standard deviation record determined in accordance with ACI 214R, based on 30 consecutive strength tests of similar mixture proportions to that proposed, obtained within 1 year of the time when concrete placing is expected, it shall be used in selecting average strength. The average strength used as the basis for selecting proportions shall exceed the specified strength f'_c by at least.

2.8 MPa if standard deviation is less than 2.1 MPa
3.8 MPa if standard deviation is 2.1 to 2.8 MPa
4.8 MPa if standard deviation is 2.8 to 3.4 MPa
6.2 MPa if standard deviation is 3.4 to 4.1 MPa

If the standard deviation exceeds 4.1 MPa or if a standard deviation record is not available, proportions shall be selected to produce an average strength at least 8.3 MPa greater than the specified strength.

Mixtures shall be proportioned in accordance with ACI 211.1. The trial mixtures shall be formulated using the same materials as those to be used in the units supplied under this specification, and the selected proportions shall be submitted for approval with the results of cylinder strengths at 28 days.

2.3 EVALUATION AND ACCEPTANCE

2.3.1 Concrete

A test result shall be the average of the strengths of the two test cylinders made in accordance with paragraph SYSTEM DESCRIPTION, subparagraph PERFORMANCE REQUIREMENTS, subparagraph CONCRETE, subparagraph "a", CONCRETE TEST CYLINDERS. The strength level of the concrete will be considered satisfactory if the average of all sets of three consecutive

strength tests equal or exceed the specified strength $f'(c)$ and no individual test falls below the specified value by more than 3.4 MPa. Members manufactured with concrete that does not meet the strength requirements shall be rejected.

2.3.1.1 Air Content

All members cast with concrete having a measured air content less than 5 percent shall be rejected. Members cast with concrete having an air content up to 9 percent may be incorporated into the work if the strength requirements are met.

2.3.2 Tolerances

The precast-prestressed members shall be manufactured within the following tolerances. Members failing to meet the dimensional tolerances shall be rejected.

2.3.2.1 Length of Member

The length of the member shall not deviate from the length shown in the contract drawings by more than plus or minus 19 mm or plus or minus 1 mm per m of length, whichever is greater.

2.3.2.2 Cross-sectional Dimensions

The cross-sectional dimensions of a member, if less than 900 mm, shall not vary by more than plus or minus 6 mm and, if over 900 mm, they shall not vary by more than plus or minus 9 mm.

2.3.2.3 Horizontal Alignment (Sweep)

The horizontal alignment of the members shall not deviate from a straight line parallel to the theoretical centerline by more than 13 mm or 1 mm per m of length, whichever is greater. The maximum gap between two adjacent members due to sweep shall not exceed 25 mm.

2.3.2.4 Position of Reinforcement

The position of the reinforcing steel shall not deviate from the design position by more than plus or minus 6 mm.

2.3.2.5 Handling Devices

The actual position of handling devices shall not deviate from the designed position by more than plus or minus 150 mm.

2.3.2.6 Anchors and Inserts

The actual position of anchors and inserts for precast to precast connections shall not vary by more than plus or minus 12 mm from positions shown in the contract drawings.

2.3.2.7 Flange Thickness

The thickness of a flange or slab shall not vary from the dimensions in the drawings by more than plus 6 mm or minus 3 mm.

2.3.2.8 Depth of Member at Support

At the supports, the depth of a member shall not deviate from the dimensions shown in the contract drawings by more than plus or minus 6 mm.

2.3.2.9 Squareness of Ends

The ends of members shall not deviate from being square by more than plus or minus 6 mm. Squareness shall be checked in both the vertical and horizontal planes.

2.3.3 Defects

2.3.3.1 Minor Defects

Minor defects are those which involve less than 900 mm² of concrete and do not expose stressing tendons or reinforcing steel. These defects will be repaired as specified hereinafter. Cracks which are visible but are 250 µm wide or less will be accepted.

2.3.3.2 Major Defects

Major defects are those which involve more than 900 mm² of concrete or expose reinforcing steel. If one or more major defects appear in a member, it shall be rejected. Cracks of a width of more than 250 µm shall be cause for rejection of the member.

PART 3 EXECUTION

3.1 FABRICATION

Fabrication of precast members shall follow the applicable provisions of the PCI MNL-116, except as specified herein.

3.2 BEDS AND FORMS

3.2.1 Casting Beds

All casting beds shall have concrete support on unyielding foundations.

3.2.2 Forms

Forms, both fixed and movable, shall be of steel. All forms and beds shall be thoroughly cleaned after each use.

3.2.3 Bulkheads

Bulkheads, spacers, templates, and similar equipment having influence on the accuracy of dimensions and alignment shall be regularly inspected and

maintained after each casting.

3.2.4 Alignment

Accurate alignment of forms shall be maintained during the casting operation to assure compliances with tolerances specified in paragraph EVALUATION AND ACCEPTANCE. Leakage of the paste in form joints is not acceptable, and measures shall be taken to prevent such leakage. Measures shall also be taken to provide corner chamfers.

3.2.5 Form Ties

For exposed members, form ties, if used, shall be of the threaded or snap-off type so no parts will be left at the surface of the finished concrete.

3.3 ANCHORAGES FOR POSTTENSIONING

Anchorage for posttensioning tendons will not interfere with the placement of the member such that adequate compaction of the concrete in the anchorage zone is impeded.

3.4 STEEL REINFORCEMENT

Steel bars and welded wire fabric shall be placed in accordance with Section 03200A CONCRETE REINFORCEMENT.

3.5 CONCRETE PLACEMENT

Concrete placement shall be in accordance with Section 03307A CONCRETE FOR MINOR STRUCTURES, except that once placement is started in a member it shall be carried on in a continuous operation until the member is completed. Members shall be cast in a horizontal position and casting in tiers will not be permitted. Adequate vibration shall be provided with internal and form vibrators so the cast members shall be free of rock pockets or surface blemishes resulting from inadequate vibration. Cold joints shall not be permitted in prestressed concrete members. If delays occur that result in hardening of the concrete so it will not receive a vibrator and again become plastic, the concrete shall be removed and the forms shall be washed out and refilled, otherwise partially cast members will be rejected.

3.6 CURING AND PROTECTION

Concrete for the manufacturing of the precast concrete members shall be cured and protected in accordance with Section 03307A CONCRETE FOR MINOR STRUCTURES or by other methods further specified here.

3.6.1 Curing with Steam at Atmospheric Pressure

Steam curing shall be under a suitable enclosure to retain the live steam to minimize moisture and heat losses. The enclosure shall allow free circulation of the steam around the sides and top of the beams. Steam jets shall be so positioned so they do not discharge directly on the concrete,

forms, or test cylinders. The cycle of steam application shall conform to the following:

3.6.1.1 Curing After Placing and Vibrating

After placing and vibrating, the concrete shall be allowed to attain its initial set before the steam is applied. During the period between placement of the concrete and application of steam, provisions shall be made to prevent surface drying by means of a coating of membrane curing compound, moist covers, or equally effective methods. Application of the steam shall be delayed not less than 2 hours and not more than 10 hours after the time of concrete placement. If the ambient temperature is below 5 degrees C, enough heat shall be applied to maintain the concrete at its placing temperature.

3.6.1.2 Temperature Increase

The ambient temperature within the casting enclosure shall be increased at a rate not to exceed 22 degrees C per hour. Temperature increase shall be as uniform as possible.

3.6.1.3 Temperature Range

The temperature shall be increased until the ambient temperature in the casting enclosure is between 60 and 71 degrees C. Once this temperature range is reached, it shall be maintained until the concrete has reached the compressive strength necessary for stressing or destressing the tendons.

3.6.1.4 Temperature Decrease

In discontinuing the steam curing, the ambient air temperature shall decrease at a rate not to exceed 22 degrees C per hour. Temperature decrease shall be as uniform as possible.

3.6.1.5 Recording Thermometers

Recording thermometers showing the time-temperature relationship through the curing period from placing concrete to transfer of prestress shall be provided. At least one recording thermometer per casting enclosure shall be used. The desired curing time-temperature relationship shall be placed on the recording chart of the recording thermometer to aid the personnel controlling the temperature during curing. Recording charts shall be made available upon request and shall be clearly visible during the curing process.

3.6.2 Curing with Radiant Heat and Moisture

3.6.2.1 Radiant Heat

Radiant heat may be applied to beds by means of pipe circulating steam, hot oil, or hot water or by electric blankets or heating elements on forms. Pipes, blankets, or elements shall not be in contact with concrete, form surface, or test cylinders.

3.6.2.2 Moisture Loss

During the cycle of radiant heat curing, effective means shall be provided to prevent rapid loss of moisture in any part of the member. Moisture may be applied by a covering of moist burlap or cotton matting. Moisture may be retained by covering the member with a plastic sheet in combination with an insulating cover or by applying a liquid seal coat or membrane curing compound.

3.6.2.3 Temperature Limits

Temperature limits and use of recording thermometer shall be as specified for curing with steam at atmospheric pressure.

3.6.2.4 Termination of Curing

Termination of curing shall be as specified in Section 03307A CONCRETE FOR MINOR STRUCTURES unless the concrete has been cured by one of the two methods stated above.

3.7 REPAIRS

All honeycombed areas, chipped corners, air pockets over 6 mm in diameter, and other minor defects shall be repaired. Form offsets of fins over 3 mm shall be ground smooth. All unsound concrete shall be removed from defective areas prior to repairing. All surfaces permanently exposed to view shall be repaired by a blend of portland cement and white cement properly proportioned so that the final color when cured will be the same as adjacent concrete.

3.8 FINISHING

3.8.1 Unformed surfaces

Unformed surfaces shall receive a wood float finish.

3.9 ERECTION

Erection shall comply with the following.

3.9.1 Storage Provisions

All provisions for storage and handling given in paragraph DELIVERY, STORAGE, AND HANDLING shall be observed at the erection site.

3.9.2 Seating of Precast Prestressed Concrete Members

The precast prestressed concrete members shall be set into place in a manner which assures full bearing. If the bearing called for in the contract drawing is not obtained, then the members shall be removed and the situation corrected.

3.9.3 Welding

Welding during erection shall be done in accordance with Section 05055A METALWORK FABRICATION, MACHINE WORK AND MISCELLANEOUS PROVISIONS. When welding or burning with a welding electrode, the ground shall be attached directly to the base metal. Under no circumstances shall the member be used as a conductor for the ground.

3.9.4 Erection Plan

The erection plan shall be in sufficient detail so that adequacy of equipment, techniques, and accessories can be determined and comments offered. Acceptance of the Contractor's erection plan shall not relieve the Contractor of his responsibility for erecting precast prestressed members into position as required by the plans and specifications.

3.10 CONSTRUCTION RECORDS

Complete construction records shall be kept of the manufacturing, handling, and erection of the precast concrete members. Records shall be kept for, but not limited to, the following items:

- a. Specifications of material used in the manufacture of the members.
- b. Records of the inspection of the members each time they are moved.
- c. Records of any defects in the member and any corrective measures taken.

-- End of Section --

SECTION 05090A

WELDING, STRUCTURAL

12/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 335 (1989) Structural Steel Buildings
Allowable Stress Design and Plastic Design

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT RP SNT-TC-1A (2001) Recommended Practice

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (1998) Standard Symbols for Welding,
Brazing and Nondestructive Examination

AWS A3.0 (2001) Standard Welding Terms and
Definitions

AWS D1.1/D1.1M (2002) Structural Welding Code - Steel

AWS Z49.1 (1999) Safety in Welding, Cutting and
Allied Processes

1.2 DEFINITIONS

Definitions of welding terms shall be in accordance with AWS A3.0.

1.3 GENERAL REQUIREMENTS

The design of welded connections shall conform to AISC 335 unless otherwise indicated or specified. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved. Welding shall be as specified in this section, except where additional requirements are shown on the drawings or are specified in other sections. Welding shall not be started until welding procedures, inspectors, nondestructive testing personnel, welders, welding operators, and tackers have been qualified and the submittals approved by the Contracting Officer. Qualification testing shall be performed at or near the work site. Each Contractor performing welding shall maintain records of the test results obtained in welding procedure, welder, welding

operator, and tacker performance qualifications.

1.3.1 Pre-erection Conference

A pre-erection conference shall be held, prior to the start of the field welding, to bring all affected parties together and to gain a naturally clear understanding of the project and the Welding Procedure Specifications (WPS) (which the Contractor shall develop and submit for all welding, including welding done using prequalified procedures). Attendees shall include all Contractor's welding production and inspection personnel and appropriate Government personnel. Items for discussion could include: responsibilities of various parties; welding procedures and processes to be followed; welding sequence (both within a joint and joint sequence within the building); inspection requirements and procedures, both visual and ultrasonic; welding schedule; fabrication of mock-up model; and other items deemed necessary by the attendees.

1.3.2 Mock-up Model

The field-welded connection designated as the mock-up model on the drawings shall be the first connection made. All welders qualified and designated to perform field-welded groove joints shall be present during the welding of the mock-up model connections and each one shall perform a part of the welding. The mock-up test shall simulate the physical and environmental conditions that will be encountered during the welding of all groove joints. All inspection procedures required for groove welded joints, including NDE tests, shall be performed on the mock-up model. All Contractor inspection and testing personnel that will perform QC of groove welded joints shall be present during the welding of the mock-up model and each one shall perform the inspection procedures to be performed on production welding of these joints. This mock-up model connection shall be the standard of performance, both for the welding and inspection procedures used and the results to be achieved in the production welding for these groove welded joints.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Welding Procedure Qualifications; G
Welder, Welding Operator, and Tacker Qualification
Inspector Qualification
Previous Qualifications
Prequalified Procedures

Copies of the welding procedure specifications; the procedure qualification test records; and the welder, welding operator, or tacker qualification test records.

SD-06 Test Reports

Quality Control

A quality assurance plan and records of tests and inspections.

1.5 WELDING PROCEDURE QUALIFICATIONS

Except for prequalified (per AWS D1.1/D1.1M) and previously qualified procedures, each Contractor performing welding shall record in detail and shall qualify the welding procedure specification for any welding procedure followed in the fabrication of weldments. Qualification of welding procedures shall conform to AWS D1.1/D1.1M and to the specifications in this section. Copies of the welding procedure specification and the results of the procedure qualification test for each type of welding which requires procedure qualification shall be submitted for approval. Approval of any procedure, however, will not relieve the Contractor of the sole responsibility for producing a finished structure meeting all the requirements of these specifications. This information shall be submitted on the forms in Appendix E of AWS D1.1/D1.1M. Welding procedure specifications shall be individually identified and shall be referenced on the detail drawings and erection drawings, or shall be suitably keyed to the contract drawings. In case of conflict between this specification and AWS D1.1/D1.1M, this specification governs.

1.5.1 Previous Qualifications

Welding procedures previously qualified by test may be accepted for this contract without requalification if the following conditions are met:

- a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.
- b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.
- c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.5.2 Prequalified Procedures

Welding procedures which are considered prequalified as specified in AWS D1.1/D1.1M will be accepted without further qualification. The Contractor shall submit for approval a listing or an annotated drawing to indicate the joints not prequalified. Procedure qualification shall be required for these joints.

1.5.3 Retests

If welding procedure fails to meet the requirements of AWS D1.1/D1.1M, the procedure specification shall be revised and requalified, or at the

Contractor's option, welding procedure may be retested in accordance with AWS D1.1/D1.1M. If the welding procedure is qualified through retesting, all test results, including those of test welds that failed to meet the requirements, shall be submitted with the welding procedure.

1.6 WELDER, WELDING OPERATOR, AND TACKER QUALIFICATION

Each welder, welding operator, and tacker assigned to work on this contract shall be qualified in accordance with the applicable requirements of AWS D1.1/D1.1M and as specified in this section. Welders, welding operators, and tackers who make acceptable procedure qualification test welds will be considered qualified for the welding procedure used.

1.6.1 Previous Personnel Qualifications

At the discretion of the Contracting Officer, welders, welding operators, and tackers qualified by test within the previous 6 months may be accepted for this contract without requalification if all the following conditions are met:

- a. Copies of the welding procedure specifications, the procedure qualification test records, and the welder, welding operator, and tacker qualification test records are submitted and approved in accordance with the specified requirements for detail drawings.
- b. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.
- c. The previously qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.
- d. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.6.2 Certificates

Before assigning any welder, welding operator, or tacker to work under this contract, the Contractor shall submit the names of the welders, welding operators, and tackers to be employed, and certification that each individual is qualified as specified. The certification shall state the type of welding and positions for which the welder, welding operator, or tacker is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person certifying the qualification tests. The certification shall be kept on file, and 3 copies shall be furnished. The certification shall be kept current for the duration of the contract.

1.6.3 Renewal of Qualification

Requalification of a welder or welding operator shall be required under any of the following conditions:

a. It has been more than 6 months since the welder or welding operator has used the specific welding process for which he is qualified.

b. There is specific reason to question the welder or welding operator's ability to make welds that meet the requirements of these specifications.

c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract, and a qualification test has not been taken within the past 12 months. Records showing periods of employment, name of employer where welder, or welding operator, was last employed, and the process for which qualified shall be submitted as evidence of conformance.

d. A tacker who passes the qualification test shall be considered eligible to perform tack welding indefinitely in the positions and with the processes for which he is qualified, unless there is some specific reason to question the tacker's ability. In such a case, the tacker shall be required to pass the prescribed tack welding test.

1.7 INSPECTOR QUALIFICATION

Inspector qualifications shall be in accordance with AWS D1.1/D1.1M. Nondestructive testing personnel shall be qualified in accordance with the requirements of ASNT RP SNT-TC-1A for Levels I or II in the applicable nondestructive testing method. The inspector may be supported by assistant welding inspectors who are not qualified to ASNT RP SNT-TC-1A, and assistant inspectors may perform specific inspection functions under the supervision of the qualified inspector.

1.8 SYMBOLS

Symbols shall be in accordance with AWS A2.4, unless otherwise indicated.

1.9 SAFETY

Safety precautions during welding shall conform to AWS Z49.1.

PART 2 PRODUCTS

2.1 WELDING EQUIPMENT AND MATERIALS

All welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator performing qualified welding procedures. All welding equipment and materials shall comply with the applicable requirements of AWS D1.1/D1.1M.

PART 3 EXECUTION

3.1 WELDING OPERATIONS

3.1.1 Requirements

Workmanship and techniques for welded construction shall conform to the requirements of AWS D1.1/D1.1M and AISC 335. When AWS D1.1/D1.1M and the AISC 335 specification conflict, the requirements of AWS D1.1/D1.1M shall govern.

3.1.2 Identification

Welds shall be identified in one of the following ways:

- a. Written records shall be submitted to indicate the location of welds made by each welder, welding operator, or tacker.
- b. Each welder, welding operator, or tacker shall be assigned a number, letter, or symbol to identify welds made by that individual. The Contracting Officer may require welders, welding operators, and tackers to apply their symbol next to the weld by means of rubber stamp, felt-tipped marker with waterproof ink, or other methods that do not cause an indentation in the metal. For seam welds, the identification mark shall be adjacent to the weld at 1 meter intervals. Identification with die stamps or electric etchers shall not be allowed.

3.2 QUALITY CONTROL

Testing shall be done by an approved inspection or testing laboratory or technical consultant; or if approved, the Contractor's inspection and testing personnel may be used instead of the commercial inspection or testing laboratory or technical consultant. The Contractor shall perform visual and radiographic, ultrasonic, and magnetic particle, or inspection to determine conformance with paragraph STANDARDS OF ACCEPTANCE. Procedures and techniques for inspection shall be in accordance with applicable requirements of AWS D1.1/D1.1M, except that in radiographic inspection only film types designated as "fine grain," or "extra fine," shall be employed.

3.3 STANDARDS OF ACCEPTANCE

Dimensional tolerances for welded construction, details of welds, and quality of welds shall be in accordance with the applicable requirements of AWS D1.1/D1.1M and the contract drawings. Nondestructive testing shall be by visual inspection and radiographic,. The minimum extent of nondestructive testing shall be random 5 percent of welds or joints, as indicated on the drawings.

3.3.1 Nondestructive Examination

The welding shall be subject to inspection and tests in the mill, shop, and field. Inspection and tests in the mill or shop will not relieve the

Contractor of the responsibility to furnish weldments of satisfactory quality. When materials or workmanship do not conform to the specification requirements, the Government reserves the right to reject material or workmanship or both at any time before final acceptance of the structure containing the weldment.

3.3.2 Destructive Tests

When metallographic specimens are removed from any part of a structure, the Contractor shall make repairs. The Contractor shall employ qualified welders or welding operators, and shall use the proper joints and welding procedures, including peening or heat treatment if required, to develop the full strength of the members and joints cut and to relieve residual stress.

3.4 GOVERNMENT INSPECTION AND TESTING

In addition to the inspection and tests performed by the Contractor for quality control, the Government will perform inspection and testing for acceptance to the extent determined by the Contracting Officer. The costs of such inspection and testing will be borne by the Contractor if unsatisfactory welds are discovered, or by the Government if the welds are satisfactory. The work may be performed by the Government's own forces or under a separate contract for inspection and testing. The Government reserves the right to perform supplemental nondestructive and destructive tests to determine compliance with paragraph STANDARDS OF ACCEPTANCE.

3.5 CORRECTIONS AND REPAIRS

When inspection or testing indicates defects in the weld joints, the welds shall be repaired using a qualified welder or welding operator as applicable. Corrections shall be in accordance with the requirements of AWS D1.1/D1.1M and the specifications. Defects shall be repaired in accordance with the approved procedures. Defects discovered between passes shall be repaired before additional weld material is deposited. Wherever a defect is removed and repair by welding is not required, the affected area shall be blended into the surrounding surface to eliminate sharp notches, crevices, or corners. After a defect is thought to have been removed, and before rewelding, the area shall be examined by suitable methods to ensure that the defect has been eliminated. Repair welds shall meet the inspection requirements for the original welds. Any indication of a defect shall be regarded as a defect, unless reevaluation by nondestructive methods or by surface conditioning shows that no unacceptable defect is present.

-- End of Section --

SECTION 05120

STRUCTURAL STEEL

08/03

PART 4 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303	(2000) Code of Standard Practice for Steel Buildings and Bridges
AISC 316	(1989) ASD Manual of Steel Construction
AISC 317	(1992) ASD Manual of Steel Construction, Vol II: Connections
AISC 325	(2001) LRFD Manual of Steel Construction
AISC 326	(2002) Detailing for Steel Construction
AISC 335	(1989) Structural Steel Buildings Allowable Stress Design and Plastic Design
AISC 341	(2002) Seismic Provisions for Structural Steel Buildings
AISC 348	(2000) Structural Joints Using ASTM A325 or A490 Bolts
AISC 350	(1999) Load and Resistance Factor Design (LRFD) Specification for Structural Steel Buildings
AISC 810	(1997) Design Guide 10: Erection Bracing of Low-Rise Structural Steel Frames/Fisher and West
AISC FCD	(1995a) AISC Quality Certification Program
AISC M018L	(1999) LRFD Manual of Steel Construction, Metric Conversion Volume I
AISC M019L	(1999) LRFD Manual of Steel Construction, Metric Conversion Volume II
AISC S340	(1992) Metric Properties of Structural

Shapes with Dimensions According to ASTM
A6M

AMERICAN WELDING SOCIETY (AWS)

- AWS A2.4 (1998) Standard Symbols for Welding,
Brazing and Nondestructive Examination
- AWS D1.1/D1.1M (2002) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

- ASME B46.1 (1995) Surface Texture, (Surface
Roughness, Waviness and Lay)

ASTM INTERNATIONAL (ASTM)

- ASTM A 123/A 123M (2002) Zinc (Hot-Dip Galvanized) Coatings
on Iron and Steel Products
- ASTM A 143 (2003) Safeguarding Against Embrittlement
of Hot-Dip Galvanized Structural Steel
Products and Procedure for Detecting
Embrittlement
- ASTM A 153/A 153M (2003) Zinc Coating (Hot-Dip) on Iron and
Steel Hardware
- ASTM A 307 (2002) Carbon Steel Bolts and Studs, 60
000 PSI Tensile Strength
- ASTM A 325M (2003) Structural Bolts, Steel, Heat
Treated, 830Mpa Minimum Tensile Strength
(Metric)
- ASTM A 36/A 36M (2003a) Carbon Structural Steel
- ASTM A 490M (2003) High-Strength Steel Bolts, Classes
10.9 and 10.9.3, for Structural Steel
Joints (Metric)
- ASTM A 500 (2003) Cold-Formed Welded and Seamless
Carbon Steel Structural Tubing in Rounds
and Shapes
- ASTM A 514/A 514M (2000a) High-Yield-Strength, Quenched and
Tempered Alloy Steel Plate, Suitable for
Welding
- ASTM A 53 (1999b) Pipe, Steel, Black and Hot-Dipped,
Zinc-Coated, Welded and Seamless
- ASTM A 563 (2000) Carbon and Alloy Steel Nuts

ASTM A 563M	(2001) Carbon and Alloy Steel Nuts (Metric)
ASTM A 6/A 6M	(2003a) General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A 780	(2001) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM A 992/A 992M	(2002) Steel for Structural Shapes for Use in Building Framing
ASTM C 1107	(2002) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 827	(2001a) Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
ASTM F 436M	(2003) Hardened Steel Washers (Metric)
ASTM F 844	(2000) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F 959M	(2002) Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners (Metric)

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1	(2000) Shop, Field, and Maintenance Painting
SSPC PS 13.01	(1982; R 2000) Epoxy-Polyamide Painting System
SSPC Paint 25	(1997; R 2000) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II
SSPC SP 3	(1982; R 2000) Power Tool Cleaning
SSPC SP 6	(2000) Commercial Blast Cleaning

1.2 SYSTEM DESCRIPTION

Provide the structural steel system, including shop primer or galvanizing as indicated, complete and ready for use. Structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing shall be provided in accordance with AISC 316 and AISC 317 or AISC 325 except as modified in this contract.

1.3 MODIFICATIONS TO REFERENCES

In AISC 316, AISC 317, AISC 335, AISC 303, AISC 348, and AISC S340, except as modified in this section, shall be considered a part of AISC 316 and AISC 317 and is referred to in this section as AISC 316 and AISC 317.

In AISC 325, AISC 350, AISC 303, AISC 348, and AISC S340, except as modified in this section, shall be considered a part of AISC M018L and AISC M019L and is referred to in this section as AISC 325.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Erection Plan, including description of temporary supports; G, AE

Fabrication drawings including description of connections; G, AE

SD-03 Product Data

Shop primer

Load indicator bolts; G, AE

Include test report for Class B primer.

SD-06 Test Reports

Class B coating

Bolts, nuts, and washers

Supply the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

SD-07 Certificates

Steel

Bolts, nuts, and washers

Shop primer

Welding electrodes and rods

Nonshrink grout

Galvanizing

Welding procedures and qualifications

1.5 SEISMIC PROVISIONS

In addition to AISC 325, the structural steel system shall be provided in accordance with AISC 341.

1.6 QUALITY ASSURANCE

1.6.1 Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 326, AISC 316 and AISC 317. Drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS A2.4 standard welding symbols. Shoring and temporary bracing shall be designed and sealed by a registered professional engineer and submitted for record purposes as part of the drawings.

1.6.2 Certifications

1.6.2.1 Erection Plan

Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing, and a detailed sequence of welding, including each welding procedure required.

1.6.2.2 Welding Procedures and Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welding operator is more than one-year old, the welding operator's qualification certificate shall be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.

PART 2 PRODUCTS

2.1 STEEL

2.1.1 Structural Steel

ASTM A 36/A 36M.

2.1.2 High-Strength Structural Steel

2.1.2.1 Low-Alloy Steel

ASTM A 992/A 992M Grade 50.

2.1.3 Structural Shapes for Use in Building Framing

Wide flange shapes, ASTM A 992/A 992M.

2.1.4 Structural Steel Tubing

ASTM A 500, Grade B.

2.1.5 Steel Pipe

ASTM A 53, Type E or S, Grade B, weight class STD (Standard).

2.2 BOLTS, NUTS, AND WASHERS

Provide the following unless indicated otherwise.

2.2.1 Structural Steel, Steel Pipe

2.2.1.1 Bolts

ASTM A 325M, Type 1. The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications.

2.2.1.2 Nuts

ASTM A 563M, Grade A , heavy hex style, except nuts under M36 may be provided in hex style.

2.2.1.3 Washers

ASTM F 844 washers for ASTM A 307 bolts, and ASTM F 436M washers for ASTM A 325M and ASTM A 490M bolts.

2.2.2 High-Strength Structural Steel and Structural Steel Tubing

2.2.2.1 Bolts

ASTM A 325M, Type 1.

2.2.2.2 Nuts

ASTM A 563M , Grade and Style as specified in the applicable ASTM bolt standard.

2.2.2.3 Washers

ASTM F 436M , plain carbon steel.

2.2.3 Foundation Anchorage

2.2.3.1 Bolts

ASTM A 36M.

2.2.3.2 Nuts

ASTM A 563 , Grade A, hex style.

2.2.3.3 Washers

ASTM F 844.

2.2.4 Load Indicator Bolts

ASTM A 325M , Type 1; ASTM A 490M, Type 1, with a manufactured notch between the bolt tip and threads. The bolt shall be designed to react to the opposing rotational torques applied by the installation wrench, with the bolt tip automatically shearing off when the proper tension is obtained.

2.2.5 Self-Locking Nuts

Provide nuts with a locking pin set in the nut. The locking pin shall slide along the bolt threads, and by reversing the direction of the locking pin, the nut shall be removed without damaging the nut or bolt. Provide stainless steel locking pins.

2.3 STRUCTURAL STEEL ACCESSORIES

2.3.1 Welding Electrodes and Rods

AWS D1.1/D1.1M.

2.3.2 Nonshrink Grout

ASTM C 1107, with no ASTM C 827 shrinkage. Grout shall be nonmetallic.

2.3.3 Welded Shear Stud Connectors

AWS D1.1/D1.1M.

2.4 SHOP PRIMER

SSPC Paint 25, (alkyd primer) or SSPC PS 13.01 epoxy-polyamide, green primer (Form 150) type 1, except provide a Class B coating in accordance with AISC 316 and AISC 317 for slip critical joints. Primer shall conform to Federal, State, and local VOC regulations. If flash rusting occurs, re-clean the surface prior to application of primer.

2.5 GALVANIZING

ASTM A 123/A 123M or ASTM A 153/A 153M, as applicable, unless specified otherwise galvanize after fabrication where practicable.

2.6 FABRICATION

2.6.1 Markings

Prior to erection, members shall be identified by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections shall be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate match markings in areas that will decrease member strength or cause stress concentrations. Affix embossed tags to hot-dipped galvanized members.

2.6.2 Shop Primer

Shop prime structural steel, except as modified herein, in accordance with SSPC PA 1. Do not prime steel surfaces embedded in concrete, galvanized surfaces, surfaces to receive sprayed-on fireproofing, or surfaces within 13 mm of the toe of the welds prior to welding (except surfaces on which metal decking is to be welded). Slip critical surfaces shall be primed with a Class B coating. Prior to assembly, prime surfaces which will be concealed or inaccessible after assembly. Do not apply primer in foggy or rainy weather; when the ambient temperature is below 7 degrees C or over 35 degrees C; or when the primer may be exposed to temperatures below 4 degrees C within 48 hours after application, unless approved otherwise by the Contracting Officer.

2.6.2.1 Cleaning

SSPC SP 6, except steel exposed in spaces above ceilings, attic spaces, furred spaces, and chases that will be hidden to view in finished construction may be cleaned to SSPC SP 3 when recommended by the shop primer manufacturer. Maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

2.6.2.2 Primer

Apply primer to a minimum dry film thickness of 0.05 mm except provide the Class B coating for slip critical joints in accordance with the coating manufacturer's recommendations. Repair damaged primed surfaces with an additional coat of primer.

2.6.3 Fireproofing Coated Surfaces

Surfaces to receive sprayed-on fireproofing coatings shall be cleaned and prepared in accordance with the manufacturer's recommendations, and as specified in Section 07810 SPRAY-APPLIED FIREPROOFING.

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC 316. Fabrication and assembly shall be done in the shop to the greatest extent possible. Compression joints depending on contact bearing shall have a surface roughness not in excess of 13 micrometer as determined by ASME B46.1, and ends shall be square within the tolerances for milled ends specified in ASTM A 6/A 6M. Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, surfaces to be fireproofed, and contact surfaces of friction-type high-strength bolted connections shall be prepared for painting in accordance with endorsement "P" of AISC FCD and primed with the specified paint.

3.2 INSTALLATION

3.3 ERECTION

- a: Erection of structural steel, except as indicated in item b. below, shall be in accordance with the applicable provisions of AISC 316, AISC 325, and endorsement F of AISC FCD. Erection plan shall be reviewed, stamped and sealed by a licensed structural engineer.
- b. For low-rise structural steel buildings (18 m tall or less and a maximum of 2 stories), the erection plan shall conform to AISC 303 and the structure shall be erected in accordance with AISC 810.

Provide for drainage in structural steel. After final positioning of steel members, provide full bearing under base plates and bearing plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions.

3.3.1 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

3.4 CONNECTIONS

Except as modified in this section, connections not detailed shall be designed in accordance with AISC 335 or AISC 350. Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Punch, subpunch and ream, or drill bolt holes. Bolts, nuts, and washers shall be clean of dirt and rust, and lubricated immediately prior to installation.

3.4.1 Common Grade Bolts

ASTM A 307 bolts shall be tightened to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If

firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

3.4.2 High-Strength Bolts

ASTM A 325M and ASTM A 490M bolts shall be fully tensioned to 70 percent of their minimum tensile strength. Provide load indicator bolts or washers in all ASTM A 325M or ASTM A 490M bolted connections, except provide only load indicator washers for slip critical connections. Direct tension indicator tightening, shall be the only acceptable tightening methods. Use only direct tension indicator tightening for slip critical connections. Bolts shall be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, bolts shall then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

3.4.2.1 Installation of Load Indicator Washers (LIW)

ASTM F 959M . Where possible, the LIW shall be installed under the bolt head and the nut shall be tightened. If the LIW is installed adjacent to the turned element, provide a flat ASTM F 436M washer between the LIW and nut when the nut is turned for tightening, and between the LIW and bolt head when the bolt head is turned for tightening. In addition to the LIW, provide flat ASTM F 436M washers under both the bolt head and nut when ASTM A 490M bolts are used.

3.5 WELDING

AWS D1.1/D1.1M, except use only shielded metal arc welding and low hydrogen electrodes for ASTM A 514/A 514M steel. Do not stress relieve ASTM A 514/A 514M steel by heat treatment. Grind exposed welds smooth as indicated. Provide AWS D1.1/D1.1M qualified welders, welding operators, and tackers.

The contractor shall develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Prequalified procedures may be submitted for information only; however, procedures that are not prequalified shall be submitted for approval.

3.5.1 Removal of Temporary Welds, Run-Off Plates, and Backing Strips

Remove only from finished areas.

3.6 SHOP PRIMER REPAIR

Repair shop primer in accordance with the paint manufacturer's recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

3.6.1 Field Priming

Field priming of steel exposed to the weather, or located in building areas without HVAC for control of relative humidity. After erection, the field

bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

3.7 GALVANIZING REPAIR

Provide as indicated or specified. Galvanize after fabrication where practicable. Repair damage to galvanized coatings using ASTM A 780 zinc rich paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces to which repair paint has been applied.

3.8 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing, except that electric power for field tests will be furnished as set forth in Division 1. The Contracting Officer shall be notified in writing of defective welds, bolts, nuts, and washers within 7 working days of the date of weld inspection.

3.8.1 Welds

3.8.1.1 Visual Inspection

AWS D1.1/D1.1M. Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification inspections. Welding inspectors shall visually inspect and mark welds, including fillet weld end returns.

3.8.1.2 Nondestructive Testing

AWS D1.1/D1.1M. Test locations shall be selected by the Contracting Officer.

If more than 20 percent of welds made by a welder contain defects identified by testing, then all welds made by that welder shall be tested by radiographic or ultrasonic testing, as approved by the Contracting Officer. When all welds made by an individual welder are required to be tested, magnetic particle testing shall be used only in areas inaccessible to either radiographic or ultrasonic testing. Retest defective areas after repair.

- a. Testing frequency: Provide the following types and number of tests:

	<u>Test Type</u>	<u>Number of Tests</u>
Officer	Radiographic	As determined by the Contracting
Officer	Ultrasonic	As determined by the Contracting
Officer	Magnetic Particle	As determined by the Contracting

Test TypeNumber of Tests

3.8.2 Load Indicator Washers

3.8.2.1 Load Indicator Washer Compression

Load indicator washers shall be tested in place to verify that they have been compressed sufficiently to provide the 0.38 mm gap when the load indicator washer is placed under the bolt head and the nut is tightened, and to provide the 0.13 mm gap when the load indicator washer is placed under the turned element, as required by ASTM F 959M.

3.8.2.2 Load Indicator Gaps

In addition to the above testing, an independent testing agency as approved by the Contracting Officer, shall test in place the load indicator gapson 20 percent of the installed load indicator washers to verify that the ASTM F 959M load indicator gaps have been achieved. If more than 10 percent of the load indicators tested have not been compressed sufficiently to provide the average gaps required by ASTM F 959M, then all in place load indicator washers shall be tested to verify that the ASTM F 959M load indicator gaps have been achieved. Test locations shall be selected by the Contracting Officer.

3.8.3 High-Strength Bolts

3.8.3.1 Testing Bolt, Nut, and Washer Assemblies

Test a minimum of 3 bolt, nut, and washer assemblies from each mill certificate batch in a tension measuring device at the job site prior to the beginning of bolting start-up. Demonstrate that the bolts and nuts, when used together, can develop tension not less than the provisions specified in AISC 348 , Table 4, depending on bolt size and grade. The bolt tension shall be developed by tightening the nut. A representative of the manufacturer or supplier shall be present to ensure that the fasteners are properly used, and to demonstrate that the fastener assemblies supplied satisfy the specified requirements.

3.8.3.2 Inspection

Inspection procedures shall be in accordance with AISC 348, Section 9. Confirm and report to the Contracting Officer that the materials meet the project specification and that they are properly stored. Confirm that the faying surfaces have been properly prepared before the connections are assembled. Observe the specified job site testing and calibration, and confirm that the procedure to be used provides the required tension. Monitor the work to ensure the testing procedures are routinely followed on joints that are specified to be fully tensioned.

3.8.3.3 Testing

The Government has the option to perform nondestructive tests on 5 percent of the installed bolts to verify compliance with pre-load bolt tension

requirements. The nondestructive testing will be done in-place using an ultrasonic measuring device or any other device capable of determining in-place pre-load bolt tension. The test locations shall be selected by the Contracting Officer. If more than 10 percent of the bolts tested contain defects identified by testing, then all bolts used from the batch from which the tested bolts were taken, shall be tested. Retest new bolts after installation.

3.8.4 Testing for Embrittlement

ASTM A 143 for steel products hot-dip galvanized after fabrication.

-- End of Section --

SECTION 05210A

STEEL JOISTS
12/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

STEEL JOIST INSTITUTE (SJI)

SJI Specs & Tables	(August 2002) Standard Specifications and Load Tables for Steel Joists and Joist Girders
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Steel Joists; G, AE

Detail drawings shall include fabrication and erection details, specifications for shop painting, and identification markings of joists and joist girders.

SD-07 Certificates

Steel Joists; G, AE

Certificates stating that the steel joists and joist girders have been designed and manufactured in accordance with SJI Specs & Tables. Complete engineering design computations may be submitted in lieu of the certification.

1.3 GENERAL REQUIREMENTS

Steel joists and joist girders are designated on the drawings in accordance with the standard designations of the Steel Joist Institute. Joists of other standard designations or joists with properties other than those shown may be substituted for the joists designated provided the structural properties are equal to or greater than those of the joists shown and

provided all other specified requirements are met.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition and stored off the ground in a well drained location, protected from damage, and easily accessible for inspection and handling.

PART 2 PRODUCTS

2.1 OPEN WEB STEEL JOISTS

Open web steel joists shall conform to SJI Specs & Tables, K-Series. Joists shall be designed to support the loads given in the standard load tables of SJI Specs & Tables.

2.2 ACCESSORIES AND FITTINGS

Accessories and fittings, including end supports and bridging, shall be in accordance with the standard specifications under which the members were designed.

2.3 SHOP PAINTING

Joists and accessories shall be shop painted with a rust-inhibiting primer paint. For joists which will be finish painted under Section 09900 PAINTS AND COATINGS, the primer paint shall be limited to a primer which is compatible with the specified finish paint.

PART 3 EXECUTION

3.1 ERECTION

Installation of joists shall be in accordance with the standard specification under which the member was produced. Joists shall be handled in a manner to avoid damage. Damaged joists shall be removed from the site, except when field repair is approved and such repairs are satisfactorily made in accordance with the manufacturer's recommendations. Joists shall be accurately set, and end anchorage shall be in accordance with the standard specification under which the joists were produced. For spans over 12 m through 18 m one row of bridging nearest midspan shall be bolted diagonal bridging; for spans over 18 m bolted diagonal bridging shall be used instead of welded horizontal bridging. Joist bridging and anchoring shall be secured in place prior to the application of any construction loads. Any temporary loads shall be distributed so that the carrying capacity of any joist is not exceeded. Loads shall not be applied to bridging during construction or in the completed work. Abraded, corroded, and field welded areas shall be cleaned and touched up with the same type of paint used in the shop painting.

-- End of Section --

SECTION 05310

STEEL DECKS
10/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-973 (1996) Cold-Formed Steel Design Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2002) Structural Welding Code - Steel

AWS D1.3 (1998) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 1008/A 1008M (2003) Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

ASTM A 653/A 653M (2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 780 (2001) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings

ASTM A 792/A 792M (2002) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

FM GLOBAL (FM)

FM DS 1-28 (2002) Design Wind Loads

FM P7825 (2003) Approval Guide

STEEL DECK INSTITUTE (SDI)

SDI 30 (2001) Design Manual for Composite Decks, Form Decks, and Roof Decks

SDI DDM02 (1991) Diaphragm Design Manual

SDI DDP (1987; R 2000) Deck Damage and Penetrations

SDI MOC1 (1991) Manual of Construction with Steel Deck

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-310-01 (2000) Load Assumptions for Buildings

UNDERWRITERS LABORATORIES (UL)

UL 580 (1994; Rev thru Feb 1998) Tests for Uplift Resistance of Roof Assemblies

UL Bld Mat Dir (2003) Building Materials Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings

SD-03 Product Data

Deck Units

Accessories

Mechanical Fasteners

SD-04 Samples

SD-05 Design Data

Deck Units

Submit manufacturer's design calculations, or applicable published literature for the structural properties of the proposed deck units.

SD-07 Certificates

Deck Units

Accessories

Qualification of Welders

Fire Safety

Wind Storm Resistance

1.3 QUALITY ASSURANCE

1.3.1 Deck Units

Deck units and accessories shall be products of a manufacturer regularly engaged in manufacture of steel decking. Provide manufacturer's certificates attesting that the decking material meets the specified requirements.

1.3.2 Certification of Piston Tool Operator

Manufacturer's certificate attesting that the operators are authorized to use the low velocity piston tool.

1.3.3 Qualification of Welders

Provide welder qualification procedures, welder qualifications, and duration of qualification period in accordance with AWS D1.1/D1.1M and AWS D1.3.

1.3.4 Regulatory Requirements

1.3.4.1 Fire Safety

Roof deck shall have been tested as a part of a roof deck construction assembly of the type used for this project, shall be listed as fire classified in the UL Bld Mat Dir, or listed as Class I construction in the FM P7825, and so labeled.

1.3.4.2 Wind Storm Resistance

The roof construction assembly shall be capable of withstanding an uplift pressure of 5 kPa when tested in accordance with the uplift pressure test described in the FM DS 1-28 or as described in UL 580 and in general compliance with UFC 3-310-01.

1.3.5 Fabrication Drawings

Show type and location of units, location and sequence of connections, bearing on supports, methods of anchoring, attachment of accessories, adjusting plate details, size and location of holes to be cut and reinforcement to be provided, the manufacturer's erection instructions and other pertinent details.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver deck units to the site in a dry and undamaged condition. Store and handle steel deck in a manner to protect it from corrosion, deformation,

and other types of damage. Do not use decking for storage or as working platform until units have been fastened into position. Exercise care not to damage material or overload decking during construction. The maximum uniform distributed storage load shall not exceed the design live load. Stack decking on platforms or pallets and cover with weathertight ventilated covering. Elevate one end during storage to provide drainage. Maintain deck finish at all times to prevent formation of rust. Repair deck finish using touch-up paint. Replace damaged material.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Steel Sheet

Flat rolled carbon steel sheets of structural quality, thickness not less than indicated mm before coating, meeting the requirements of AISI SG-973, except as modified herein.

2.1.2 Steel Coating

ASTM A 653/A 653M designation Z275 galvanized, or ASTM A 792/A 792M designation AZ165, aluminum-zinc alloy. Apply coating to both sides of sheet.

2.2 ACCESSORIES

Provide accessories of same material as deck, unless specified otherwise. Provide manufacturer's standard type accessories, as specified.

2.2.1 Adjusting Plates

Provide adjusting plates, or segments of deck units, of same thickness and configuration as deck units in locations too narrow to accommodate full size units. Provide factory cut plates of predetermined size where possible.

2.2.2 End Closures

Fabricated of sheet metal by the deck manufacturer. Provide end closures minimum 0.75 mm thick to close open ends at exposed edges of floors, end walls, and openings through deck.

2.2.3 Partition Closures

Provide closures for closing voids above interior walls and partitions that are perpendicular to the direction of the configurations. Provide rubber, plastic, or sheet steel closures above typical partitions. Provide sheet steel closures above fire-resistant interior walls and partitions located on both sides of wall or partition.

2.2.4 Closure Plates for Composite Deck

The concrete shall be supported and retained at each floor level. Provide

edge closures at all edges of the slab of sufficient strength and stiffness to support the wet concrete. Metal closures shall be provided for all openings in composite steel deck 6 mm and over.

2.2.5 Sheet Metal Collar

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.2.6 Cover Plates

Sheet metal to close panel edge and end conditions, and where panels change direction or butt. Polyethylene-coated, self-adhesive, 50 mm wide joint tape may be provided in lieu of cover plates on flat-surfaced decking butt joints.

2.2.7 Sump Pans

Sump pans shall be provided for roof drains and shall be minimum 2 mm thick steel, recessed type. Sump pans shall be shaped to meet roof slope by the supplier or by a sheet metal specialist. Bearing flanges of sump pans shall overlap steel deck a minimum of 75 mm. Opening in bottom of pan shall be shaped, sized, and reinforced to receive roof drain.

2.2.8 Column Closures

Sheet metal, minimum 0.85 mm thick or metal rib lath.

2.2.9 Access Hole Covers

Sheet metal, minimum 1.2 mm thick.

2.2.10 Hanger

Provide clips or loops for utility systems and suspended ceilings of one or more of the following types:

- a. Lip tabs or integral tabs where noncellular decking or flat plate of cellular section is 1.2 mm thick or more, and a structural concrete fill is used over deck.
- b. Slots or holes punched in decking for installation of pigtails.
- c. Tabs driven from top side of decking and arranged so as not to pierce electrical cells.
- d. Decking manufacturer's standard as approved by the Contracting Officer.

2.2.11 Mechanical Fasteners

Provide mechanical fasteners, such as powder actuated or pneumatically driven fasteners, for anchoring the deck to structural supports and

adjoining units that are designed to meet the loads indicated. Provide positive locking-type fasteners standard with the Steel Deck Institute and the steel deck manufacturer, as approved by the Contracting Officer.

2.2.12 Miscellaneous Accessories

The manufacturer's standard accessories shall be furnished as necessary to complete the deck installation. Metal accessories shall be of the same material as the deck and have minimum design thickness as follows: saddles, 1.204 mm; welding washers, 1.519 mm; cant strip, 0.749 mm; other metal accessories, 0.909 mm; unless otherwise indicated. Accessories shall include but not be limited to saddles, welding washers, fasteners, cant strips, butt cover plates, underlapping sleeves, and ridge and valley plates.

2.3 FABRICATION

2.3.1 Deck Units

Deck units shall conform to SDI 30. Form and non-cellular decking and accessories shall conform to ASTM A 653/A 653M, SQ, Grade 230, Grade 33; ASTM A 1008/A 1008M Coated Carbon Steel Sheets, Grade C, 228 mPa, 33, 000 psi minimum yield strength; or ASTM A 792/A 792M Coated Steel Sheets, Grade 33. Panels of maximum possible lengths shall be used to minimize end laps.

Deck units shall be fabricated in lengths to span 3 or more supports with flush, telescoped, or nested 50 mm laps at ends, and interlocking, or nested side laps, unless otherwise indicated. Deck with cross-sectional configuration differing from the units indicated may be used, provided that the properties of the proposed units, determined in accordance with AISI SG-973, are equal to or greater than the properties of the units indicated and that the material will fit the space provided without requiring revisions to adjacent materials or systems.

2.3.2 Deck

Deck used in built-up flooring shall conform to ASTM A 792/A 792M or ASTM A 1008/A 1008M. Deck units shall be fabricated of the steel design thickness required by the design drawings and shall be galvanized.

PART 3 EXECUTION

3.1 EXAMINATION

Prior to installation of decking units and accessories, examine worksite to verify that as-built structure will permit installation of decking system without modification.

3.2 INSTALLATION

Install steel deck units in accordance with SDI DDM02 and approved shop drawings. Place units on structural supports, properly adjusted, leveled, and aligned at right angles to supports before permanently securing in place. Damaged deck and accessories including material which is permanently stained or contaminated, deformed, or with burned holes shall

not be installed. Extend deck units over three or more supports unless absolutely impractical. Report inaccuracies in alignment or leveling to the Contracting Officer and make necessary corrections before permanently anchoring deck units. Locate deck ends over supports only. Ends of floor deck may be lapped or butted. Do not use unanchored deck units as a work or storage platform. Permanently anchor units placed by the end of each working day. Do not support suspended ceilings, light fixtures, ducts, utilities, or other loads by steel deck unless indicated. Loads shall be distributed by appropriate means to prevent damage. Acoustical material shall be neatly fitted into the rib voids.

3.2.1 Attachment

Immediately after placement and alignment, and after correcting inaccuracies, permanently fasten steel deck units to structural supports and to adjacent deck units by welding with normal 19mm diameter puddle welds as indicated on the design drawings and in accordance with manufacturer's recommended procedure and SDI 30. Clamp or weight deck units to provide firm contact between deck units and structural supports while performing welding or fastening. Anchoring the deck to structural supports with powder-actuated fasteners or pneumatically driven fasteners is prohibited. Attachment of adjacent deck units by button-punching is prohibited.

3.2.1.1 Welding

Perform welding in accordance with AWS D1.3 using methods and electrodes recommended by the manufacturers of the base metal alloys being used. Ensure only operators previously qualified by tests prescribed in AWS D1.1/D1.1M and AWS D1.3 make welds. Immediately recertify, or replace with qualified welders, welders that have passed qualification tests but are producing unsatisfactory welding. Location, size, and spacing of fastening shall be as indicated. Welding washers shall be used at the connections of the deck to supports. Welding washers shall not be used at sidelaps. Holes and similar defects will not be acceptable. Deck ends shall be lapped 50 mm. All partial or segments of deck units shall be attached to structural supports in accordance with Section 2.5 of SDI DDM02. . Immediately clean welds by chipping and wire brushing. Heavily coat welds, cut edges and damaged portions of coated finish with zinc-dust paint conforming to ASTM A 780 .

3.2.1.2 Fastening

Anchor deck to adjoining units with mechanical deck fasteners as recommended by the Steel Deck Institute and the steel deck manufacturer, as approved by the Contracting Officer. Powder-actuated fasteners shall be driven with a low-velocity piston tool by an operator authorized by the manufacturer of the piston tool. Pneumatically driven fasteners shall be driven with a low-velocity fastening tool and shall comply with the manufacturer's recommendations.

3.2.2 Openings

All holes and openings required shall be cut or drilled holes and be

coordinated with the drawings, specifications, and other trades. Frame and reinforce openings through the deck in conformance with SDI DDP. Holes and openings 150 to 300 mm across shall be reinforced by 1.204 mm thick steel sheet at least 300 mm wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 150 mm on center. Holes and openings larger than 300 mm shall be reinforced by steel channels or angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Steel channels or angles shall be installed perpendicular to the deck ribs and shall be fastened to the channels or angles perpendicular to the steel joists. Deck manufacturer shall approve holes or openings larger than 150 mm in diameter prior to drilling or cutting. Openings shall not interfere with seismic members such as chords and drag struts.

3.2.3 Deck Damage

SDI MOC1, for repair of deck damage.

3.2.4 Accessory Installation

3.2.4.1 Adjusting Plates

Install as shown on shop drawings.

3.2.4.2 End Closures

Provide end closure to close open ends of cells at columns, walls, and openings in deck.

3.2.4.3 Closures Above Partitions

Provide for closing voids between cells over partitions that are perpendicular to direction of cells. Provide a one-piece closure strip for partitions 100 mm nominal or less in thickness and two-piece closure strips for wider partitions. Provide sheet metal closures above fire-rated partitions at both sides of partition with space between filled with fiberglass insulation. Provide flexible rubber closures above acoustic-rated partitions at both sides of partition with space between filled with blanket insulation.

3.2.4.4 Column Closures

Provide for spaces between floor decking and columns which penetrate the deck. Field cut closure plate to fit column in the field and tack weld to decking and columns.

3.2.4.5 Access Hole Covers

Provide to seal holes cut in decking to facilitate welding of decking to structural supports.

3.2.4.6 Hangers

Provide as indicated to support utility system and suspended ceilings.

Space devices so as to provide one device per 0.60 square meters.

3.2.5 Sound Absorbing Material

Install sound absorbing glass fiber roll or premolded form, neatly in voids between perforated webs of acoustical noncellular steel deck. Keep sound absorbing material dry before, during and after installation.

3.2.6 Preparation of Fire-Proofed Surfaces

Deck surfaces, both composite and noncomposite, which are to receive sprayed-on fireproofing, shall be galvanized and shall be free of all grease, mill oil, paraffin, dirt, salt, and other contaminants which impair adhesion of the fireproofing. Any required cleaning shall be done prior to steel deck installation using a cleaning method that is compatible with the sprayed-on fireproofing.

3.3 FIELD QUALITY CONTROL

3.3.1 Decks Not Receiving Concrete

Inspect the decking top surface for distortion after installation. For decks not receiving concrete, verify distortion by placing a straight edge across three adjacent top flanges. The maximum allowable gap between the straight edge and the top flanges is 2 mm; when gap is more than 2 mm, provide corrective measures or replacement. Reinspect decking after performing corrective measures or replacement.

-- End of Section --

SECTION 05400

COLD-FORMED METAL FRAMING

10/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISI SG02-1 (2001) North American Specification for the Design of Cold-Formed Steel Structural Members

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-973 (1996) Cold-Formed Steel Design Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3 (1998) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153/A 153M (2003) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 370 (2003a) Mechanical Testing of Steel Products

ASTM A 653/A 653M (2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM B 633 (1998e1) Electrodeposited Coatings of Zinc on Iron and Steel

ASTM C 955 (2003) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases

ASTM E 329 (2002) Agencies Engaged in the Testing

and/or Inspection of Materials Used in
Construction

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J78 (1998) Steel Self Drilling Tapping Screws

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-P-664 (Rev. D) Primer Coating, Alkyd,
Corrosion-Inhibiting, Lead and Chromate
Free, VOC-Compliant

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Framing Components; G, AE

- a. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.
- b. Connection details showing fastener type, quantity, location, and other information to assure proper installation.
- c. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

SD-03 Product Data

Steel studs, joists, purlins, tracks, bracing, bridging and accessories for pre-engineered roof truss system

SD-05 Design Data

Metal framing calculations pre-engineered roof truss system; G, AE

SD-07 Certificates

Load-bearing cold-formed metal framing

Mill certificates or test reports from independent testing agency, qualified in accordance with ASTM E 329, showing that the steel sheet used in the manufacture of each cold-formed component complies with the minimum yield strengths and uncoated steel

thickness specified. Test reports shall be based on the results of three coupon tests in accordance with ASTM A 370.

Welds

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.3.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to job site and store in adequately ventilated, dry locations. Storage area shall permit easy access for inspection and handling. If necessary to store materials outside, stack off the ground, support on a level platform, and protect from the weather as approved. Handle materials to prevent damage. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content, galvanizing repair paint whenever necessary to prevent the formation of rust. Replace damaged items with new, as directed by the Contracting Officer.

1.4 LOAD-BEARING COLD-FORMED METAL FRAMING

Include top and bottom tracks, bracing, fastenings, and other accessories necessary for complete installation. Framing members shall have the structural properties indicated. Where physical structural properties are not indicated, they shall be as necessary to withstand all imposed loads. Design framing in accordance with AISI SG-973. Non-load-bearing metal framing, furring, and ceiling suspension systems are specified in Section 09100N METAL SUPPORT ASSEMBLIES. Metal suspension systems for acoustical ceilings are specified in Section 09510 ACOUSTICAL CEILINGS.

1.5 MAXIMUM DEFLECTION

a. Exterior Studs:

<u>Deflection Criteria</u>	<u>Exterior Finish</u>
L/240 or L/360	Synthetic Plaster, Metal Panels
L/360	Cement Plaster, Wood Veneer
L/600	Brick Veneer, Stone Panels

Wall deflections shall be computed on the basis that studs withstand all lateral forces independent of any composite action from sheathing materials. Studs abutting windows or louvers shall also be designed not to exceed 6 mm maximum deflection.

b. Roof Rafters/Trusses:

L/240 - Live load only

1.6 QUALITY ASSURANCE

1.6.1 Drawing Requirements

Submit framing components to show sizes, thicknesses, layout, material designations, methods of installation, and accessories.

1.6.2 Design Data Required

Submit metal framing calculations to verify sizes, gages, and spacing of members and connections. Show methods and practices used in installation.

PART 2 PRODUCTS

2.1 STEEL STUDS, JOISTS, PURLINS, TRACKS, BRACING, BRIDGING AND ACCESSORIES FOR PRE-ENGINEERED ROOF TRUSS SYSTEM

Framing components shall comply with ASTM C 955 and the following.

2.1.1 Studs, Joists and Purlins of 1.5 mm and Heavier

Galvanized steel, ASTM A 653/A 653M, SS Grade 50, Z275.

2.1.2 Studs, Joists and Purlins of 1.2 mm and Lighter

Studs and Joists of 1.2 mm and Lighter, Track, and Accessories (All Gages):
Galvanized steel, ASTM A 653/A 653M, SS, Grade 345 230 MPa Z180.

2.1.3 Sizes, Gages, Section Modulus, and Other Structural Properties

Size and gage as indicated. Steel stud deflection shall be limited to L/600 for exterior wall brick veneer construction.

2.2 MARKINGS

Studs and track shall have product markings stamped on the web of the section. The markings shall be repeated throughout the length of the member at a maximum spacing of 1200 mm on center and shall be legible and easily read. The product marking shall include the following:

- a. An ICBO number.
- b. Manufacturer's identification.
- c. Minimum delivered uncoated steel thickness.
- d. Protective coating designator.
- e. Minimum yield strength.

2.3 CONNECTIONS

Screws for steel-to-steel connections shall be self-drilling tapping in compliance with SAE J78 of the type, size, and location as shown on the

drawings. Electroplated screws shall have a Type II coating in accordance with ASTM B 633. Screws, bolts, and anchors shall be hot-dipped galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate. Screws bolts, and anchors shall be hot dipped galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate.

2.4 PAINT

Ungalvanized steel, if used, shall be thoroughly cleaned, phosphate treated, and coated with corrosion-inhibiting primer, FS TT-P-664.

2.5 PLASTIC GROMMETS

Supply plastic grommets, recommended by stud manufacturer, to protect electrical wires. Prevent metal to metal contact for plumbing pipes.

PART 3 EXECUTION

3.1 FASTENING

Fasten framing members together by welding or by using self-drilling or self-tapping screws. Electrodes and screw connections shall be as required and indicated in the design calculations.

3.1.1 Welds

All welding shall be performed in accordance with AWS D1.3, as modified by AISI SG02-1. All welders, welding operations, and welding procedures shall be qualified according to AWS D1.3. All welds shall be cleaned and coated with rust inhibitive galvanizing paint. Do not field weld materials lighter than 1.2 mm.

3.1.2 Screws

Screws shall be self-drilling self-tapping type, size, and location shown on the drawings. Screw penetration through joined materials shall not be less than three exposed threads. Minimum spacings and edge distances for screws shall be as specified in AISI SG02-1. Screws covered by sheathing materials shall have low profile heads.

3.1.3 Anchors

Anchors shall be of the type, size, and location shown on the drawings.

3.2 INSTALLATION

3.2.1 Tracks

Provide accurately aligned runners at top and bottom of partitions. Anchor tracks as indicated in design calculations. Butt weld joints in tracks or splice with stud inserts. Fasteners shall be at least 75 mm from the edge of concrete slabs.

3.2.2 Studs

Cut studs square and set with firm bearing against webs of top and bottom tracks. Position studs vertically in tracks and space as indicated in design. Do not splice studs. Provide at least two studs at jambs of doors and other openings 600 mm wide or larger. Provide jack studs over openings, as necessary, to maintain indicated stud spacing. Provide tripled studs at corners, positioned to receive interior and exterior finishes. Fasten studs to top and bottom tracks by welding or screwing both flanges to the tracks. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all openings that are larger than the stud spacing in a wall. In curtain wall construction, provide for vertical movement where studs connect to the structural frame. Provide horizontal bracing in accordance with the design calculations and AISI SG-973, consisting of, as a minimum, runner channel cut to fit between and welded to the studs or hot- or cold-rolled steel channels inserted through cutouts in web of each stud and secured to studs with welded clip angles. Bracing shall be not less than the following:

<u>LOAD</u>	<u>HEIGHT</u>	<u>BRACING</u>
Wind load only	Up to 3000 mm	One row at mid-height
	Over 3000 mm	Rows 1500 mm o.c. maximum
Axial load	Up to 3000 mm	Two rows at 1/3 points
	Over 3000 mm	Rows 900 mm o.c. maximum

3.2.3 Joists and Trusses

Locate each joist or truss directly above a stud. Provide doubled joists under parallel partitions wherever partition length exceeds 1/2 of joist span. Joists shall have at least 60 mm of bearing on steel, 100 mm on masonry, and shall be reinforced over bearings where required to prevent web crippling. Splice joists over bearings only. Lap and weld splices as indicated. Provide manufacturer's standard bridging which shall not be less than the following:

<u>CLEAR SPAN</u>	<u>BRIDGING</u>
Up to 4200 mm	One row near center
4200 mm to 6000 mm	Two rows at 1/3 points
6000 mm to 7800 mm	Three rows at 1/4 points
7800 mm to 10600 mm	Four rows at 1/5 points

Temporary bracing shall be provided and remain in place until work is permanently stabilized.

3.2.4 Erection Tolerances

- a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:

- (1) Layout of walls and partitions: 6 mm from intended position;
 - (2) Plates and runners: 6 mm in 2400 mm from a straight line;
 - (3) Studs: 6 mm in 2400 mm out of plumb, not cumulative; and
 - (4) Face of framing members: 6 mm in 2400 mm from a true plane.
- b. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive shall be within the following limits:
- (1) Layout of walls and partitions: 6 mm from intended position;
 - (2) Plates and runners: 3 mm in 2400 mm from a straight line;
 - (3) Studs: 3 mm in 2400 mm out of plumb, not cumulative; and
 - (4) Face of framing members: 3 mm in 2400 mm from a true plane.

3.2.5 Special Inspection and Testing for Seismic-Resisting Systems

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01452A SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

-- End of Section --

SECTION 05500A

MISCELLANEOUS METAL
01/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (2003) Designation System for Aluminum Finishes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A14.3 (2002) Standard for Fixed Ladders and Safety Requirements

ANSI MH28.1 (1997) Design, Testing, Utilization, and Application of Industrial Grade Steel Shelving

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2002) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 36/A 36M (2003a) Carbon Structural Steel

ASTM A 467/A 467M (2001) Machine and Coil Chain

ASTM A 475 (1998) Zinc-Coated Steel Wire Strand

ASTM A 53/A 53M (2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 653/A 653M (2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 924/A 924M (1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531 (2000) Metal Bar Grating Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10 (2002) Portable Fire Extinguishers

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-344 (Rev B) Lacquer (Clear Gloss)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Miscellaneous Metal Items.

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates.

1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1/D1.1M. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123/A 123M, ASTM A 653/A 653M, or ASTM A 924/A 924M, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.5 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.6 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

1.7 ALUMINUM FINISHES

Unless otherwise specified, aluminum items shall have anodized finish. The thickness of the coating shall be not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF-45. Items to be anodized shall receive a polished satin finish. Aluminum surfaces to be in contact with plaster or concrete during construction shall be protected with a field coat conforming to CID A-A-344.

1.8 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS

Doors and panels shall be flush type unless otherwise indicated. Frames for access doors shall be fabricated of not lighter than 1.52 mm (16 gauge) steel with welded joints and finished with anchorage for securing into construction. Access doors shall be a minimum of 350 by 500 mm and of not lighter than 1.9 mm (14 gauge) steel, with stiffened edges, complete with attachments. Access doors shall be hinged to frame and provided with a flush face, screw driver operated latch. Exposed metal surfaces shall have

a baked enamel finish.

2.2 CORNER GUARDS AND SHIELDS

Corner guards and shields for jambs and sills of openings and edges of platforms shall be steel shapes and plates anchored in masonry or concrete with welded steel straps or end weld stud anchors. Corner guards for use with glazed or ceramic tile finish on walls shall be formed of 1.6 mm thick corrosion-resisting steel with polished or satin finish, shall extend 1.5 m above the top of cove base or to the top of the wainscot, whichever is less, and shall be securely anchored to the supporting wall. Corner guards on exterior shall be galvanized.

2.3 DOOR GUARDS

Door guards shall be constructed of woven steel wire or expanded metal framed with structural steel shapes. Expanded metal guards shall be of 38 mm No. 10 mesh, welded to 25 by 25 by 3 mm angle frame. Woven-wire panel shall be of 10 gauge, 38 mm mesh secured through weaving to 25 mm channel frame or around a 10 m round bar frame. Corners of frames shall be mitered and welded. Guards shall be sized as indicated.

2.4 PIPE GUARDS

Pipe guards shall be heavy duty steel pipe conforming to ASTM A 53/A 53M, Type E or S, weight STD, black finish.

2.5 SERRATED FLOOR GRATINGS AND FRAMES

Carbon steel grating shall be designed in accordance with NAAMM MBG 531 or NAAMM MBG 532 as applicable to meet the indicated load requirements. Edges shall be banded with bars 6 mm less in height than bearing bars for grating sizes above 19 mm. Banding bars shall be flush with the top of bearing grating. Frames shall be of welded steel construction finished to match the grating. Floor gratings and frames shall be galvanized after fabrication. All floor grating will have a serrated top surface for traction. Refer to General Note 14 of sheet S-102 for additional serrated grating requirements.

2.6 HANDRAILS

Handrails shall be designed to resist a concentrated load of 890 N (200 pounds) in any direction at any point of the top of the rail or 292 Newtons per meter (20 pounds per foot) applied horizontally to top of the rail, whichever is more severe.

2.6.1 Steel Handrails, Including Carbon Steel Inserts

Steel handrails, including inserts in concrete, shall be steel pipe conforming to ASTM A 53/A 53M. Steel railings shall be 40 mm nominal size. Exterior railings shall be hot-dip galvanized. Interior handrails to be shop painted. Pipe collars shall be hot-dip galvanized steel.

a. Joint posts, rail, and corners shall be fabricated by one of the

following methods:

(1) Flush type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 10 mm hexagonal recessed-head setscrews.

(2) Mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices shall be butted and reinforced by a tight fitting interior sleeve not less than 150 mm long.

(3) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

- b. Removable sections, toe-boards, and brackets shall be provided as indicated.

2.7 GUY CABLES FOR INTERIOR STAIRS

Guy cables shall be prestretched, galvanized wire rope of the sizes indicated. Wire rope shall conform to ASTM A 475, high strength grade with Class A coating. Guys shall have a factory attached clevis top-end fitting; guys shall have a factory attached open-bridge strand socket bottom-end fitting; guys shall be complete with oval eye, threaded anchor rods. Fittings and accessories shall be stainless steel.

2.8 LADDERS

Ladders shall be galvanized steel, fixed rail type in accordance with ANSI A14.3.

2.9 METAL GRID WALKWAYS

Metal grid walkways shall be designed to provide a walkable surface in the attic for maintenance personnel, 2.0 mm (12 gauge) minimum aluminum. The walkway shall consist of metal planks, 610 by 3050 or 3650 mm, bolted or welded to support angles. Other sizes may be furnished if approved. In addition to end supports, a midspan support shall be provided when required to limit deflection. End supports shall be located to provide continuous runs.

2.10 MIRROR FRAMES

Frames for plate glass mirrors larger than 450 by 750 mm shall be fabricated from extruded aluminum with anodized finish. Frames shall be provided with concealed fittings and tamperproof mountings.

2.11 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

2.12 SAFETY CHAINS

Safety chains shall be galvanized welded steel, proof coil chain tested in accordance with ASTM A 467/A 467M, Class CS. Safety chains shall be straight link style, 5 mm diameter, minimum 39 links per meter (12 links per foot) and with bolt type snap hooks on each end. Eye bolts for attachment of chains shall be galvanized 10 mm bolt with 19 mm eye, anchored as indicated. Two chains shall be furnished for each guarded opening.

2.13 SAFETY NOSING

Safety nosings shall be of cast aluminum with cross-hatched, abrasive surface. Nosing shall be 75 mm wide and terminating at not more than 150 mm from the ends of treads, except nosing for metal pan cement-filled treads shall extend the full length of the tread. Safety nosings shall be provided with anchors not less than 19 mm long. Integrally cast mushroom anchors are not acceptable.

2.14 SHELVING

Shelving shall conform to ANSI MH28.1 and shall be bolted and capable of resisting a uniform load of 45 kg per meter. Minimum dimensions and number of shelves shall be as indicated.

2.15 STEEL STAIRS

Steel stairs shall be complete with structural or formed channel stringers, metal pan cement-filled treads, grating treads, landings, columns, handrails, and necessary bolts and other fastenings as indicated. Structural steel shall conform to ASTM A 36/A 36M. Stairs and accessories shall be galvanized. Risers on stairs with metal pan treads shall be deformed to form a sanitary cove to retain the tread concrete. Integral nosings shall have braces extended into the concrete fill. Gratings for treads and landings shall conform to NAAMM MBG 531. Grating treads shall have slip-resistant nosings.

2.16 STEEL DOOR FRAMES

Steel door frames built from structural shapes shall be neatly mitered and securely welded at the corners with all welds ground smooth. Jambs shall be provided with 50 by 6 by 300 mm bent, adjustable metal anchors spaced not over 760 mm on centers. Provision shall be made to stiffen the top member for all spans over 900 mm. Continuous door stops shall be made of 38 by 16 mm bars.

2.17 PORTABLE FIRE EXTINGUISHERS AND CABINETS

Fire Extinguisher and Cabinet Manufacturer:

- a. Alta Extinguisher Cabinet- Model Number Type 7080- Potter-Roemer or approved equal.
- b. Portable Extinguisher- Model Number Type 3020- ABC Dry Chemical.

Potter-Roemer or approved equal.

- c. Number required- 3 per floor level in addition to one portable extinguisher in each mechanical and electric room. Cabinet not required for mechanical and electric room extinguishers.
- d. Cabinets to be located in fire-rated walls shall be fire-rated type, fabricated in accordance with ASTM E 814, and shall be listed by an approved testing agency for 1- and 2-hour combustible and non-combustible wall systems.
- e. The testing agency's seal shall be affixed to each fire-rated cabinet. Cabinets shall be of the semi-recessed type suitable for 10 kg extinguishers. Box and trim shall be of heavy gage rolled steel. Door shall be a rigid frame with full length piano type hinge and double strength (DSA) glass panel. Door and panel to be stainless steel through out.

2.18 Galvanized Steel Fence

Refer to sheets A-201 A-202 for steel fence locations. See Keyed Note Item 5.20).

a. Acceptable Products

- (1). Ametco's Blockade design - 1-3/16" x 5/32" main bar, 1/4" round cross bar, 2-7/16" x 5-3/16" mesh. Electro-forged welded steel fencing Galvanized to ASTM 123 Wt. 3.67 lbs. per sq. ft. (www.Ametco.com).
- (2). Panelhegn Type 701- Manufactured by Isoj-hegn (www.Ishoj-hegn.dk)

Note: Galvanized Steel Fence to be provided with 900 mm by 900 mm panel (gate) access. Refer to sheets A-201 and A-202 for panel locations. See Keyed Note Item 5.21.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

3.2 REMOVABLE ACCESS PANELS

A removable access panel not less than 300 by 300 mm shall be installed directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would otherwise not be accessible.

3.3 ATTACHMENT OF HANDRAILS

Toeboards and brackets shall be installed where indicated. Splices, where required, shall be made at expansion joints. Removable sections shall be installed as indicated.

3.3.1 Installation of Steel Handrails

3.3.1.1 For Interior Handrails

Installation shall be base plates bolted to stringers or structural steel framework. Rail ends shall be secured by steel pipe flanges through-bolted to a back plate or by 6 mm lag bolts to studs or solid backing.

3.3.1.2 For Exterior Handrails

Installation shall be fixing by bolts to supporting steel structure or by expansion bolts/chemical anchors to concrete foundation.

3.4 ERECTION OF GUY CABLES

Guy cables shall be erected as indicated.

3.5 INSTALLATION OF METAL GRID WALKWAYS

As indicated on drawings.

3.6 PARTITION POSTS AND OPENINGS

Posts shall be set in shoes bolted to the floor and in caps tap-screwed to clip angles in overhead construction, as indicated. Openings shall be formed using channels similar to the partition frames at ducts, pipes, and other obstructions.

3.7 MOUNTING OF SAFETY CHAINS

Safety chains shall be mounted 1070 mm and 610 mm above the floor.

3.8 INSTALLATION OF SAFETY NOSINGS

Nosing shall be completely embedded in concrete before the initial set of the concrete occurs and shall finish flush with the top of the concrete surface.

3.9 DOOR FRAMES

Door frames shall be secured to the floor slab by means of angle clips and expansion bolts. Continuous door stops shall be welded to the frame or tap-screwed with countersunk screws at no more than 450 mm centers, assuring in either case full contact with the frame. Any necessary reinforcements shall be made and the frames shall be drilled and tapped as required for hardware.

3.10 INSTALLATION OF FIRE EXTINGUISHER CABINETS

Metal fire extinguisher cabinets shall be furnished and installed in accordance with NFPA 10 where shown on the drawings or specified.

-- End of Section --

SECTION 06100N

ROUGH CARPENTRY

09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules (2003) Rules for the Measurement &
Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules (2003) Standard Grading Rules for
Northeastern Lumber

REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD
ASSOCIATION (CRA)

RIS Grade Use (1998) Redwood Lumber Grades and Uses

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Spec (1986; Supple No. 1, Aug 1993) Standard
Specifications for Grades of Southern
Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003 (2002) Standard Grading Rules for Southern
Pine Lumber

U.S. DEPARTMENT OF COMMERCE (DOC)

PS-56 (1973) Structural Glued Laminated Timber

PS1 (1995) Construction and Industrial Plywood
(APA V995)

PS20 (1999) American Softwood Lumber Standard

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17 (2000) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5

(1998) Western Lumber Grading Rules

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Preservative-treated lumber and plywood

SD-07 Certificates

Certificates of grade

1.3 DELIVERY AND STORAGE

Deliver materials to the site in an undamaged condition. Store materials off the ground to provide proper ventilation, with drainage to avoid standing water, and protection against ground moisture and dampness. Store materials with a moisture barrier at both the ground level and as a cover forming a well ventilated enclosure. Remove defective and damaged materials and provide new materials.

1.4 GRADING AND MARKING

1.4.1 Lumber

Mark each piece of framing and board lumber or each bundle of small pieces of lumber with the grade mark of a recognized association or independent inspection agency. Such association or agency shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used.

1.4.2 Plywood

Mark each sheet with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark shall identify the plywood by species group or span rating, exposure durability classification, grade, and compliance with PS1.

1.5 SIZES AND SURFACING

PS20 for dressed sizes of yard and structural lumber. Lumber shall be surfaced four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced. Other

measurements are IP or SI standard.

1.6 MOISTURE CONTENT

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products shall be as follows at the time of delivery to the job site:

- a. Framing lumber and boards - 19 percent maximum
- b. Timbers 125 mm and thicker - 25 percent maximum
- c. Materials other than lumber - Moisture content shall be in accordance with standard under which the product is produced

1.7 QUALITY ASSURANCE

1.7.1 Drawing Requirements

For fabricated structural members, trusses, glu-lam members, indicate materials, details of construction, methods of fastening, and erection details. Include reference to design criteria used and manufacturers design calculations. Submit drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.

1.7.2 Data Required

Submit calculations and drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.

1.7.3 Certificates of Grade

Submit certificates attesting that products meet the grade requirements specified in lieu of grade markings where appearance is important and grade marks will deface material.

PART 2 PRODUCTS

2.1 LUMBER

2.1.1 Framing Lumber

Framing lumber such as studs, plates, caps, collar beams, cant strips, bucks, sleepers, nailing strips, and nailers and board lumber such as subflooring and wall and roof sheathing shall be one of the species listed in the table below. Minimum grade of species shall be as listed. Finger-jointed lumber may be used in the same applications as solid lumber of an equivalent species and grade, provided the finger-jointed lumber meets all the requirements of the certification and the quality control programs of the rules writing agency having jurisdiction and all applicable requirements of PS-56.

Table of Grades for Framing and Board Lumber

<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
WWPA G-5 Aspen standard grading rules	All Species: Douglas Fir-Larch Douglas Fir South Engelmann Spruce -Lodgepole Pine Engelmann Spruce Hem-Fir Idaho White Pine Lodgepole Pine Mountain Hemlock Mountain Hemlock -Hem-Fir Ponderosa Pine -Sugar Pine Ponderosa Pine -Lodgepole Pine Subalpine Fir White Woods Western Woods Western Cedars Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m and shorter)	All Species: No. 3 Common
WCLIB 17 standard grading rules	Douglas Fir-Larch Hem-Fir Mountain Hemlock Sitka Spruce Western Cedars Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m and shorter)	All Species: Standard
SPIB 1003 standard grading rules	Southern Pine	Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m and shorter)	No. 2 Boards
SCMA Spec standard specifications	Cypress	No. 2 Common	No. 2 Common
NELMA Grading Rules standard grading rules	Balsam Fir Eastern Hemlock -Tamarack Eastern Spruce Eastern White Pine	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for	All Species: No. 3 Common except Stan- dard for Eastern White and Northern

Table of Grades for Framing and Board Lumber

<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
	Northern Pine	2x4 nominal size,	Pine
	Northern Pine	3 m and shorter)	
	Cedar		
RIS Grade Use Construction standard specifications	Redwood	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m and shorter)	Heart
NHLA Rules rules for the measurement and inspection of hardwood and cypress lumber	Cypress	No. 2 Dimension	No. 2 Common

PART 3 EXECUTION

-- End of Section --

SECTION 06200A

FINISH CARPENTRY

11/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C20	(1999) Structural Lumber Fire-Retardant Treatment by Pressure Processes
AWPA C27	(1999) Plywood - Fire-Retardant Treatment by Pressure Processes
AWPA C9	(2000) Plywood - Preservative Treatment by Pressure Processes
AWPA P5	(2002) Standard for Waterborne Preservatives

ASTM INTERNATIONAL (ASTM)

ASTM D 2898	(1994; R 1999) Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
ASTM F 547	(2001) Nails for Use with Wood and Wood-Base Materials

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules	(2003) Standard Grading Rules for Northeastern Lumber
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REDWOOD INSPECTION SERVICE (RIS)

RIS Grade Use	(1998) Redwood Lumber Grades and Uses
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SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Spec	(1986; Supple No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress
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SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003 (2002) Grading Rules

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17 (2000) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5 (1998) Western Lumber Grading Rules

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Finish Carpentry

Drawings showing fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

SD-03 Product Data

Manufacturer's printed data, showing texture, density, catalog cuts, and installation instructions.

Wood Items, Siding, and Trim

Manufacturer's printed data indicating the usage of engineered or recycled wood products, and environmentally safe preservatives.

SD-04 Samples

Moldings

Samples shall be of sufficient size to show patterns, color ranges, and types, as applicable, of the material proposed to be used.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 WOOD ITEMS, SIDING, AND TRIM

The Contractor shall furnish products which optimize design by reducing the amount of wood used (engineered wood), by using recycled wood products and preservatives without arsenic or chromium when the products and methods are competitive in price or directed by the Contracting Officer. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood, wood structural panels, and lumber, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

2.1.2 Sizes and Patterns

Lumber sizes and patterns shall conform to rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Sizes and patterns for materials other than lumber shall conform to requirements of the rules or standards under which produced. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Moisture Content

The maximum moisture content of untreated trim and wood siding shall be 15 percent at the time of delivery to the jobsite and when installed. Moisture content of all other material shall be in accordance with the standard under which the product is produced.

2.1.4 Preservative Treatment

2.1.4.1 Plywood

Plywood shall be treated in accordance with AWPA C9 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

- a. 4 kg per cubic meter (0.25 pcf) intended for above ground use.
- b. 6.4 kg per cubic meter (0.4 pcf) intended for ground contact and fresh water use.

2.1.5 Fire-Retardant Treatment

Fire-retardant treated lumber shall be pressure treated in accordance with AWPA C20. Fire-retardant treated plywood shall be pressure treated in accordance with AWPA C27. Material use shall be defined in AWPA C20 and AWPA C27 for Interior Type A and B and Exterior Type. Treatment and performance inspection shall be by a qualified independent testing agency that establishes performance ratings. Each piece or bundle of treated material shall bear identification of the testing agency to indicate performance with such rating. Treated materials to be exposed to rain wetting shall be subjected to an accelerated weathering technique in accordance with ASTM D 2898, Method A, prior to being tested for compliance with AWPA C20 or AWPA C27.

2.1.6 Siding

2.1.6.1 Panel Hardboard Siding

Hardboard siding in window lighting is to be 22 mm plywood including laminate sheet.

2.1.7 Fascias and Trim

2.1.7.1 Wood

Fascias and trim, including exterior door and window casing, shall be species and grade listed in TABLE I at the end of this section. Sizes shall be as indicated. Metal corners may be furnished in lieu of wood cornerboards for horizontal siding; and if furnished, shall be galvanized steel and primed or aluminum and primed.

2.1.8 Woodwork Items

2.1.8.1 Bulletin Boards

Bulletin boards shall have a hardwood or aluminum frame, 6 mm (1/4 inch) thick plywood or hardboard back; and a 6 mm (1/4 inch) thick, dense, smooth faced corkboard face securely cemented to the back.

2.1.8.2 Utility Shelving

Utility shelving shall be a suitable species equal to or exceeding requirements of No. 3 Common white fir under WWPA G-5, 25 mm thick; or plywood, interior type, Grade A-B, 13 mm (1/2 inch) thick, any species group.

2.2 NAILS

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend 40 mm into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

PART 3 EXECUTION

3.1 MOLDING AND INTERIOR TRIM

Molding and interior trim shall be installed straight, plumb, level and with closely fitted joints. Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners. Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Window and door trim shall be provided in single lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied. Screws shall be used for attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used.

3.2 WOODWORK ITEMS

3.2.1 Bulletin Boards and Chalkboards

Items shall be installed in accordance with the manufacturer's recommendation.

3.2.2 Shelving

Shelving shall be anchored to supporting construction. Unless otherwise indicated, shelves shall be supported by wall-supported brackets not more than 600 mm on center or as required to limit deflection to 6 mm between supports with a load of 525 N per meter. Adjustable shelf hardware shall be steel standards, channel shaped, with 25 mm adjustment slots and brackets designed for attachment to standards.

3.3 TABLES

TABLE I. SPECIES AND GRADE TABLES

Grading Rules	Species	Choice	Clear	C Select	C & Better
NELMA Grading Rules					
	Eastern Cedar				X
	Eastern Hemlock		X		
	Tamarack				X
	Eastern W. Pine				X
	Northern Pine				X
	Eastern Spruce			X	
	Balsam Fir		X		
RIS Grade Use	Redwood			X	
SCMA Spec	Cypress			X	
SPIB 1003	Southern Pine				X
WCLIB 17	Douglas Fir				X
	Larch				X
	Hemlock Fir				X

TABLE I. SPECIES AND GRADE TABLES

Grading Rules	Species	Choice	Clear	C Select	C & Better
WWPA G-5	Mountain Hemlock				X
	Sitka Spruce				X
	Douglas Fir				X
	Larch				X
	Hemlock Fir		X		
	Mountain Hemlock				X
	Western Larch		X		
	Idaho White Pine	X			
	Lodgepole Pine		X		
	Ponderosa Pine		X		
	Sugar Pine		X		
	Englemann Spruce		X		
	Douglas Fir South		X		
	Subalpine Fir		X		

NOTE 1: Western Cedar under WCLIB 17 shall be Grade B; and under WWPA G-5, Western Cedar shall be Grade B bevel for siding and Grade A for trim.

NOTE 2: Except as specified in NOTE 3 below, siding and exterior trim shall be any of the species listed above. Interior trim shall be any one of the species listed above and the highest grade of the species for stain or natural finish and one grade below highest grade of species for paint finish.

NOTE 3: Southern Yellow Pine, Douglas Fir, Larch, Western Larch, and Tamarack shall not be used where painting is required and may be used on exterior work only when approved and stained with a preservative type stain.

-- End of Section --

SECTION 06650

SOLID POLYMER (SOLID SURFACING) FABRICATIONS
10/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|-------------|--|
| ANSI A108.1 | (1999) Installation of Ceramic Tile;
including A108.1A-C, 108.4-.13, 118.1-.10,
A136.1 |
| ANSI Z124.3 | (1995) Plastic Lavatories |
| ANSI Z124.6 | (1997) Plastic Sinks |

ASTM INTERNATIONAL (ASTM)

- | | |
|-------------|--|
| ASTM D 2583 | (1995; R 2001e1) Indentation Hardness of
Rigid Plastics by Means of a Barcol
Impressor |
| ASTM D 570 | (1998) Water Absorption of Plastics |
| ASTM D 638 | (2002a) Tensile Properties of Plastics |
| ASTM D 696 | (2003) Coefficient of Linear Thermal
Expansion of Plastics Between Minus 30
degrees C and 30 degrees C With a Vitreous
Silica Dilatometer |
| ASTM E 84 | (2003) Surface Burning Characteristics of
Building Materials |
| ASTM G 21 | (1996; R 2002) Determining Resistance of
Synthetic Polymeric Materials to Fungi |

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- | | |
|-----------|---|
| NEMA LD 3 | (2000) High-Pressure Decorative Laminates |
|-----------|---|

1.2 GENERAL DESCRIPTION

Work in this section includes items utilizing solid polymer (solid surfacing) fabrication as shown on the drawings and as described in this

specification.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings; G
Installation; G

Shop Drawings indicating locations, dimensions, component sizes, fabrication and joint details, attachment provisions, installation details, and coordination requirements with adjacent work.

SD-03 Product Data

Solid polymer material
Qualifications
Fabrications

Product data indicating product description, fabrication information, and compliance with specified performance requirements for solid polymer, joint adhesive, sealants, and heat reflective tape. Both the manufacturer of materials and the fabricator shall submit a detailed description of operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

SD-04 Samples

Material; G

A minimum 100 by 100 mm sample of each color and pattern for approval. Samples shall indicate full range of color and pattern variation. Approved samples shall be retained as a standard for this work.

Counter and Vanity Tops; G

A minimum 300 mm wide by 150 mm deep, full size sample for each type of counter top shown on the project drawings. The sample shall include the edge profile and backsplash as detailed on the project drawings. Solid polymer material shall be of a pattern and color as indicated on the drawings. Sample shall include at least one seam. Approved sample shall be retained as

standard for this work.

SD-06 Test Reports

Solid polymer material

Test report results from an independent testing laboratory attesting that the submitted solid polymer material meets or exceeds each of the specified performance requirements.

SD-07 Certificates

Fabrications Qualifications

Solid polymer manufacturer's certification attesting to fabricator qualification approval.

SD-10 Operation and Maintenance Data

Clean-up

A minimum of six copies of maintenance data indicating manufacturer's care, repair and cleaning instructions. Maintenance video shall be provided, if available. Maintenance kit for matte finishes shall be submitted.

1.4 DELIVERY, STORAGE AND HANDLING

Materials shall not be delivered to project site until areas are ready for installation. Materials shall be stored indoors and adequate precautions taken to prevent damage to finished surfaces. Protective coverings shall be provided to prevent physical damage or staining following installation, for duration of project.

1.5 WARRANTY

Manufacturer's warranty of ten years against defects in materials, excluding damages caused by physical or chemical abuse or excessive heat, shall be provided. Warranty shall provide for material and labor for replacement or repair of defective material for a period of ten years after component installation.

1.6 QUALIFICATIONS

To insure warranty coverage, solid polymer fabricators shall be certified to fabricate by the solid polymer material manufacturer being utilized. All fabrications shall be marked with the fabricator's certification label affixed in an inconspicuous location. Fabricators shall have a minimum of 5 years of experience working with solid polymer materials.

1.7 MOCK-UP

The Contractor shall submit Shop Drawings as specified in the Submittals

paragraph, under SD-02. Prior to final approval of shop drawings, a full-size mock-up shall be provided of a typical vanity top countertop where multiple units are required. The mock-up shall include all solid polymer components required to provide a completed unit. The mock-up shall utilize finishes in patterns and colors indicated on the drawings. Should the mock-up not be approved, the Contractor shall re-work or remake it until approval is secured. Rejected units shall be removed from the jobsite. Approved mock-up may remain as part of the finished work.

PART 2 PRODUCTS

2.1 MATERIAL

Solid polymer material shall be a homogeneous filled solid polymer; not coated, laminated or of a composite construction; meeting ANSI Z124.3 and ANSI Z124.6 requirements. Material shall have minimum physical and performance properties specified. Superficial damage to a depth of 0.25 mm shall be repairable by sanding or polishing. Material thickness shall be as indicated on the drawings. In no case shall material be less than 6 mm in thickness.

2.1.1 Cast, 100 Percent Acrylic Polymer Solid Surfacing Material

Cast, 100 percent acrylic solid polymer material shall be composed of acrylic polymer, mineral fillers, and pigments and shall meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	422 kg/cm ²	ASTM D 638
Hardness	55-Barcol Impressor (min.)	ASTM D 2583
Thermal Expansion	.0000386cm/cm/degC	ASTM D 696
Boiling water Surface Resistance	No Change	NEMA LD 3-3.05
High Temperature Resistance	No Change	NEMA LD 3-3.06
Impact Resistance (Ball drop)		NEMA LD 3-303
6.4 mm sheet	910 mm, 227 g ball, no failure	
12.7 mm sheet	3550 mm, 227 g ball, no failure	
19 mm sheet	5070 mm, 227 m ball, no failure	

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Mold & Mildew Growth	No growth	ASTM G 21
Bacteria Growth	No Growth	ASTM G 21
Liquid Absorption (Weight in 24 hrs.)	0.1% max.	ASTM D 570
Flammability		ASTM E 84
Flame Spread	25 max.	
Smoke Developed	30 max	

2.1.2 Material Patterns and Colors

Patterns and colors for all solid polymer components and fabrications shall be those indicated on the project color schedule. Pattern and color shall occur, and shall be consistent in appearance, throughout the entire depth (thickness) of the solid polymer material.

2.1.3 Surface Finish

Exposed finished surfaces and edges shall receive a uniform appearance. Exposed surface finish shall be matte; gloss rating of 5-20.

2.2 ACCESSORY PRODUCTS

Accessory products, as specified below, shall be manufactured by the solid polymer manufacturer or shall be products approved by the solid polymer manufacturer for use with the solid polymer materials being specified.

2.2.1 Seam Adhesive

Seam adhesive shall be a two-part adhesive kit to create permanent, inconspicuous, non-porous, hard seams and joints by chemical bond between solid polymer materials and components to create a monolithic appearance of the fabrication. Adhesive shall be approved by the solid polymer manufacturer. Adhesive shall be color-matched to the surfaces being bonded where solid-colored, solid polymer materials are being bonded together. The seam adhesive shall be clear or color matched where particulate patterned, solid polymer materials are being bonded together.

2.2.2 Panel Adhesive

Panel adhesive shall be neoprene based panel adhesive meeting ANSI A108.1, Underwriter's Laboratories (UL) listed. This adhesive shall be used to bond solid polymer components to adjacent and underlying substrates.

2.2.3 Silicone Sealant

Sealant shall be a mildew-resistant, FDA and UL listed silicone sealant or caulk in a clear formulation. The silicone sealant shall be approved for use by the solid polymer manufacturer. Sealant shall be used to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures.

2.2.4 Conductive Tape

Conductive tape shall be manufacturer's standard foil tape, 0.1 mm thick, applied around the edges of cut outs containing hot or cold appliances.

2.2.5 Insulating Felt Tape

Insulating tape shall be manufacturer's standard product for use with drop-in food wells used in commercial food service applications to insulate solid polymer surfaces from hot or cold appliances.

2.3 FABRICATIONS

Components shall be factory or shop fabricated to the greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and manufacturer's requirements. Factory cutouts shall be provided for sinks, lavatories, and plumbing fixtures where indicated on the drawings. Contours and radii shall be routed to template, with edges smooth. Defective and inaccurate work will be rejected.

2.3.1 Joints and Seams

Joints and seams shall be formed between solid polymer components using manufacturer's approved seam adhesive. Joints shall be inconspicuous in appearance and without voids to create a monolithic appearance.

2.3.2 Edge Finishing

Rout and finish component edges to a smooth, uniform appearance and finish. Edge shapes and treatments, including any inserts, shall be as detailed on the drawings. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

2.3.3 Counter and Vanity Top Splashes

Backsplashes and end splashes shall be fabricated from 13 mm thick solid surfacing material and shall be 100 mm high. Backsplashes and end splashes shall be provided for all counter tops and vanity tops. Backsplashes shall be shop fabricated and be permanently attached.

2.3.3.1 Permanently Attached Backsplash

Permanently attached backsplashes shall be attached straight with seam adhesive to form a 90 degree transition.

2.3.3.2 End Splashes

End splashes shall be provided loose for installation at the jobsite after horizontal surfaces to which they are to be attached have been installed.

2.3.4 Shelving

Shelving shall be fabricated from 19 mm thick solid surfacing, solid polymer material. Dimensions, edge shape, and other details shall be as indicated on the drawings.

2.3.5 Window Stools

Window stools shall be fabricated from 13 mm thick solid surfacing, solid polymer material. Dimensions, edge shape, and other details shall be as indicated on the drawings.

2.3.6 Counter and Vanity Tops

All solid surfacing, solid polymer counter top and vanity top components shall be fabricated from 13 mm thick material. Edge details, dimensions, locations, and quantities shall be as indicated on the Drawings. Counter tops shall be complete with 100 mm high permanently attached, 90 degree transition. Attach 50 mm wide reinforcing strip of polymer material under each horizontal counter top seam.

2.3.6.1 Counter Top With Sink

A. Stainless Steel Sink.

Countertops with sinks shall include cutouts to template as furnished by the sink manufacturer. Manufacturer's standard sink mounting hardware for stainless steel rimless installation shall be provided. Seam between sink and counter top shall be sealed with silicone sealant. Sink, faucet, and plumbing requirements shall be in accordance with Section 15400A PLUMBING, GENERAL PURPOSE.

2.3.7 Solid Polymer Vanity Bowls

Solid polymer vanity bowls shall be a standard product of the solid polymer manufacturer, designed specifically to be installed in solid polymer vanity tops. Bowls shall be of the same polymer composition as the adjoining counter top. Bowl design shall support a seam adhesive undermount installation method. Bowl dimensions shall be as indicated on the drawings.

PART 3 EXECUTION

3.1 COORDINATION

In most instances, installation of solid polymer fabricated components and assemblies will require strong, correctly located structural support provided by other trades. To provide a stable, sound, secure installation, close coordination is required between the solid polymer

fabricator/installer and other trades to insure that necessary structural wall support, cabinet counter top structural support, proper clearances, and other supporting components are provided for the installation of wall panels, countertops, shelving, and all other solid polymer fabrications to the degree and extent recommended by the solid polymer manufacturer. Contractor shall appropriate staging areas for solid polymer fabrications.

3.2 INSTALLATION

3.2.1 Components

All components and fabricated units shall be installed plumb, level, and rigid. Field joints between solid polymer components to provide a monolithic appearance shall be made using solid polymer manufacturer's approved seam adhesives, with joints inconspicuous in the finished work. Metal or vitreous china sinks and lavatory bowls shall be attached to counter tops using solid polymer manufacturer's recommended clear silicone sealant and mounting hardware. Solid polymer sinks and bowls shall be installed using a color-matched seam adhesive. Plumbing connections to sinks and lavatories shall be made in accordance with Section 15400A PLUMBING, GENERAL PURPOSE.

3.2.1.1 Loose Counter Top Splashes

Loose splashes shall be mounted in locations as noted on the drawings. Loose splashes shall be adhered to the counter top with a color matched silicone sealant when the solid polymer components are solid colors. Adhesion of particulate patterned solid polymer splashes to counter tops shall utilize a clear silicone sealant.

3.2.2 Silicone Sealant

A clear, silicone sealant or caulk shall be used to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures. Sealant bead shall be smooth and uniform in appearance and shall be the minimum size necessary to bridge any gaps between the solid surfacing material and the adjacent surface. Bead shall be continuous and run the entire length of the joint being sealed.

3.2.3 Plumbing

Plumbing connections to sinks and lavatories shall be made in accordance with Section 15400A.

3.3 CLEAN-UP

Components shall be cleaned after installation and covered to protect against damage during completion of the remaining project items. Components damaged after installation by other trades will be repaired or replaced at the General Contractor's cost. Component supplier will provide a repair/replace cost estimate to the General Contractor who shall approve estimate before repairs are made. The Contractor shall submit maintenance data as specified in the Submittals paragraph, under SD-10.

-- End of Section --

SECTION 07212N

MINERAL FIBER BLANKET INSULATION

09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 665	(2001e1) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 930	(1999) Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D 3833/D 3833M	(1996; R 2001) Water Vapor Transmission of Pressure-Sensitive Tapes
ASTM D 4397	(2002) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E 136	(1999e1) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E 84	(2003) Surface Burning Characteristics of Building Materials
ASTM E 96	(2000e1) Water Vapor Transmission of Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	(2003) Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 31	(2001) Installation of Oil Burning Equipment
NFPA 54	(2002) National Fuel Gas Code
NFPA 70	(2002) National Electrical Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134

Respiratory Protection

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Blanket insulation

Sill sealer insulation

Vapor retarder

Pressure sensitive tape

Accessories

SD-08 Manufacturer's Instructions

Insulation

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

Deliver materials to site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.3.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

1.4 SAFETY PRECAUTIONS

1.4.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in

accordance with 29 CFR 1910.134.

1.4.2 Smoking

Do not smoke during installation of blanket thermal insulation.

1.4.3 Other Safety Concerns

Consider other safety concerns and measures as outlined in ASTM C 930.

PART 2 PRODUCTS

2.1 BLANKET INSULATION

ASTM C 665, Type I, blankets with non-reflective coverings; Class A, membrane-faced surface with a flame spread of 25 or less and a smoke developed rating of 150 or less when tested in accordance with ASTM E 84.

In wall construction blanket insulation is 50 mm, 75 mm or 100 mm, fit to the constructions. Blanket insulation data in floor and roof-construction please not structural systems and product specifications.

Weight of insulation must be minimum 50 Kg/m³. Type Rockwool insulation blanket systems or equal.

2.1.1 Thermal Resistance Value (R-VALUE)

Pending.

2.1.2 Recycled Materials

Provide Thermal Insulation containing recycled materials to the extent practicable, provided the material meets all other requirements of this section. The minimum required recycled materials content by weight are:

Rock Wool: 75 percent slag
Fiberglass: 20 to 25 percent glass cullet

2.1.3 Prohibited Materials

Do not provide asbestos-containing materials.

2.2 SILL SEALER INSULATION

ASTM C 665, Type I.

2.3 BLOCKING

Wood, metal, unfaced mineral fiber blankets in accordance with ASTM C 665, Type I, or other approved materials. Use only non-combustible materials meeting the requirements of ASTM E 136 for blocking around chimneys and heat producing devices.

2.4 VAPOR RETARDER

- a. 0.15 mm thick polyethylene sheeting conforming to ASTM D 4397 and having a water vapor permeance of $5.72 \times 10^{-8} \text{ g/Pa.s.m}^2$ or less when tested in accordance with ASTM E 96.
- b. Vapor is to be installed in ceiling construction in JNCO and SNCO bathrooms between gypsum boards. Connection to constructions is to be executed with joint Type Sikasil S.

2.5 PRESSURE SENSITIVE TAPE

As recommended by the vapor retarder manufacturer and having a water vapor permeance rating of $5.72 \times 10^{-8} \text{ g/Pa.s.m}^2$ or less when tested in accordance with ASTM D 3833/D 3833M.

2.6 ACCESSORIES

2.6.1 Adhesive

As recommended by the insulation manufacturer.

2.6.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

2.6.3 Wire Mesh

Corrosion resistant and as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Blocking at Attic Vents and Access Doors

Prior to installation of insulation, install permanent blocking to prevent insulation from slipping over, clogging, or restricting air flow through soffit vents at eaves. Install permanent blocking around attic trap doors.

3.1.2 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

- a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless these are certified by the manufacturer for installation surrounded by insulation: 75 mm from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 600 mm above fixture.
- b. Masonry chimneys or masonry enclosing a flue: 50 mm from outside face of masonry. Masonry chimneys for medium and high heat

operating appliances: Minimum clearances required by NFPA 211.

- c. Vents and vent connectors used for venting the products of combustion and flues: Minimum clearances as required by NFPA 211.
- f. Gas Fired Appliances: Clearances as required in NFPA 54.
- g. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking around flues and chimneys is not required when insulation blanket, including any attached vapor retarder, passed ASTM E 136, in addition to meeting all other requirements stipulated in Part 2. Blocking is also not required if the chimneys are certified by the manufacturer for use in contact with insulating materials.

3.2 INSTALLATION

3.2.1 Insulation

Install and handle insulation in accordance with manufacturer's instructions. Keep material dry and free of extraneous materials. Ensure personal protective clothing and respiratory equipment is used as required. Observe safe work practices.

3.2.1.1 Electrical wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.2.1.2 Continuity of Insulation

Install blanket insulation to butt tightly against adjoining blankets and to studs, rafters, joists, sill plates, headers and any obstructions. Where insulation required is thicker than depth of joist, provide full width blankets to cover across top of joists. Provide continuity and integrity of insulation at corners, wall to ceiling joints, roof, and floor. Avoid creating thermal bridges.

3.2.1.3 Installation at Bridging and Cross Bracing

Insulate at bridging and cross bracing by splitting blanket vertically at center and packing one half into each opening. Butt insulation at bridging and cross bracing; fill in bridged area with loose or scrap insulation.

3.2.1.4 Cold Climate Requirement

Place insulation to the outside of pipes.

3.2.1.5 Insulation Blanket with Affixed Vapor Retarder

Locate vapor retarder as indicated. Do not install blankets with affixed vapor retarders unless so specified. Unless the insulation manufacturer's instructions specifically recommend not to staple the flanges of the vapor retarder facing, staple flanges of vapor retarder at 150 mm intervals flush

with face or set in the side of truss, joist, or stud. Avoid gaps and bulges in insulation and "fishmouth" in vapor retarders. Overlap both flanges when using face method. Seal joints and edges of vapor retarder with pressure sensitive tape. Stuff pieces of insulation into small cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills, band joists, and headers. Cover these insulated cracks with vapor retarder material and tape all joints with pressure sensitive tape to provide air and vapor tightness.

3.2.1.6 Insulation without Affixed Vapor Retarder

Provide snug friction fit to hold insulation in place. Stuff pieces of insulation into cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills, band joists, and headers.

3.2.1.7 Sizing of Blankets

Provide only full width blankets when insulating between trusses, joists, or studs. Size width of blankets for a snug fit where trusses, joists or studs are irregularly spaced.

3.2.1.8 Special Requirements for Ceilings

Place insulation under electrical wiring occurring across joists. Pack insulation into narrowly spaced framing. Do not block flow of air through soffit vents. Attach insulation to attic door by adhesive or staples.

3.2.1.9 Installation of Sill Sealer

Size sill sealer insulation and place insulation over top of masonry or concrete perimeter walls or concrete perimeter floor slab on grade. Fasten sill plate over insulation.

3.2.1.10 Special Requirements for Floors

Hold insulation in place with corrosion resistant wire mesh, wire fasteners, or wire lacing.

3.2.1.11 Access Panels and Doors

Affix blanket insulation to access panels greater than one square foot and access doors in insulated floors and ceilings. Use insulation with same R-Value as that for floor or ceiling.

3.2.2 Installation of Separate Vapor Retarder

Apply continuous vapor retarder as indicated. Overlap joints at least 150 mm and seal with pressure sensitive tape. Seal at sill, header, windows, doors and utility penetrations. Repair punctures or tears with pressure sensitive tape.

-- End of Section --

SECTION 07410N

METAL ROOF AND INSULATED WALL PANELS

09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2002) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM A 653/A 653M (2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 924/A 924M (1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM B 117 (2002) Operating Salt Spray (Fog) Apparatus

ASTM D 1654 (1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ASTM D 2244 (2002e1) Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

ASTM D 2247 (2002) Testing Water Resistance of Coatings in 100% Relative Humidity

ASTM D 4214 (1998) Evaluating the Degree of Chalking of Exterior Paint Films

ASTM D 522 (1993a; R 2001) Mandrel Bend Test of Attached Organic Coatings

ASTM D 714 (2002) Evaluating Degree of Blistering of Paints

ASTM D 968 (1993; R 2001) Abrasion Resistance of Organic Coatings by Falling Abrasive

ASTM E 1592	(2001) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM G 23	(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
ASTM G 26	(1996) Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)	
SMACNA Arch. Manual	(1993; Errata; Addenda Oct 1997; 4th Printing 1999) Architectural Sheet Metal Manual

1.2 DEFINITIONS

1.2.1 Corrugated Sheet

Metal sheet with finish coating system which is bent into standard corrugated shapes by roll-forming.

1.2.2 Finish Coating System

Factory-applied, organic coating system which is applied over sheet.

1.2.3 Flat Metal Sheet

Relatively thin, rectangular in cross-section and form, protected from corrosion by metallic coating bonded to base metal (with exception of aluminum alloy 3004), produced in commercial sizes, and usually furnished in coiled lengths for further processing.

1.2.4 Panel

One of series of standard-sized units produced by factory cutting of longer lengths of corrugated sheet, ready for installation as preformed metal roofing or siding.

1.2.5 Edge Creepage

Measurement of expected performance at conditions of field cut panel edges, drilled hole edges or site scratches of protective coating through handling or tool misuse.

1.2.6 Preformed

Roll formed, in the field or factory, to the manufacturer's approved configuration prior to installation.

1.2.7 System

The composite assembly of all components of the roof or wall system; including insulation, flashings, fasteners, other accessories, sealants, and transitions at roof and/or wall penetrating elements; necessary for a watertight installation.

1.3 PERFORMANCE REQUIREMENT

1.3.1 Deflection

When subjected to full design loads, steel wall and roof panels shall not deflect more than 1/180 of panels' clear span.

1.3.2 Wind Uplift

The structural performance test methods and requirements of the roof and wall systems and attachments shall be in accordance with ASTM E 1592.

Roof and wall systems and attachments shall resist the following wind loads as determined by ASCE 7, in kilograms per square meter, with a factor of safety appropriate for the material holding the anchor:

Roofs	Negative	Positive
a. At eaves	690	60
b. At rakes	370	60
c. At ridge	370	60
Roofs and Walls		
d. At building corners	410	280
e. At central areas	250	280

1.3.3 Formability Test

In accordance with ASTM D 522, finish coating system shall show no microchecking of exterior film with no loss of adhesion, when subjected to 180-degree bend over 3 mm diameter mandrel and 10 mm diameter mandrel for coatings 0.10 mm or thicker.

1.3.4 Weathering Test

Sample of finished-coated sheet shall withstand weathering test for minimum of 2,000 hours in accordance with ASTM G 23 or ASTM G 26 without cracking, peeling, blistering, loss of adhesion of finish coating system or corrosion of base metal. Finish coating system that can be readily removed from base metal with penknife blade or similar instrument shall be considered to indicate loss of adhesion.

1.3.5 Chalking Resistance

After 2,000-hour weathering test, finish coating system shall not chalk less than No. 8 rating when measured in accordance with ASTM D 4214 test procedures.

1.3.6 Color Change

After 2,000-hour weathering test, color change of finish coating system shall not exceed two NBS units when measured in accordance with ASTM D 2244 test procedures.

1.3.7 Specular Gloss

According to manufacturers specifications.

1.3.8 Salt Spray Test

Withstand a salt spray test for a minimum of 1000 hours in accordance with ASTM B 117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, coating shall receive a rating of 10, no blisters in field as determined by ASTM D 714; and an average rating of 2 mm failure at scribe, as determined by ASTM D 1654. Rating Schedule No. 1.

1.3.9 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, coating system shall withstand minimum of 50 liters of sand per mil of coating thickness before appearance of base metal.

1.3.10 Humidity Test

When subjected to humidity cabinet test in accordance with ASTM D 2247 for 1,000 hours, factory-finished, organic-coated panel shall show no signs of blistering, cracking, creepage, or corrosion with no loss of adhesion.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Panels; G

Fasteners; G

Supports; G

Flashing; G

Closures; G

In addition to the manufacturer's printed installation instruction manual and standard details, submit drawings to supplement the instructions and details. Drawings shall be thorough and show typical and special conditions including flashings, materials and thickness, dimensions, fixing lines, anchoring methods, sealant locations, sealant tape locations, fastener layout, sizes, and spacing, terminations, penetrations, attachments, and provisions for thermal movement. Details of installation shall be in accordance with the manufacturer's standard instructions and details or the SMACNA Arch. Manual. Prior to submitting shop drawings, have drawings reviewed and approved by the manufacturer's technical engineering department.

SD-03 Product Data

Panels; G

Accessories

Fasteners

Sample warranty certificate; G

Submit catalog cuts, technical data sheets, and descriptive literature.

SD-04 Samples

Panels; G

Submit one sample of each color indicated. When colors are not indicated, submit minimum six different samples of manufacturer's standard colors for selection.

SD-06 Test Reports

Formability test

Weathering test

Chalking resistance

Color change

Specular gloss

Salt spray test

Abrasion resistance test

Humidity test

Wind uplift

Submit reports performed by independent qualified testing laboratories.

SD-07 Certificates

Qualification of installer

Certify that the installer meets requirements specified under paragraph entitled "Qualification of Installer," and include the roofing system manufacturer's written approval of the installer.

SD-11 Closeout Submittals

Information card

For each roofing installation, submit a typewritten card or photoengraved aluminum card containing the information listed on Form 1 located at the end of this section.

1.5 QUALITY ASSURANCE

1.5.1 Preroofing Conference

After submittals are received and approved but before roofing and insulation work, including associated work, is performed, the Contracting Officer will hold a preroofing conference to review the following:

- a. The drawings and specifications
- b. Procedure for on site inspection and acceptance of the roofing substrate and pertinent structural details relating to the roofing system
- c. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing
- d. Safety requirements.

The preroofing conference shall be attended by the Contractor and personnel directly responsible for the roofing and insulation installation.

1.5.2 Manufacturer's Technical Representative

The representative shall have authorization from manufacturer to approve field changes and be thoroughly familiar with the products and with installations in the geographical area where construction will take place.

The representative shall be available to perform field inspections and attend meetings as required herein and as requested by the Contracting

Officer.

1.5.3 Qualification of Installer

The roofing system installer shall be factory-trained and approved by the metal roofing system manufacturer to install the system.

1.6 DELIVERY, STORAGE, AND HANDLING

Carefully deliver, store, and handle panels and other manufactured products. Stack materials stored on site on platforms or pallets, and cover with tarpaulins or other weathertight covering. Do not use plastic which may cause sweating or condensation. Store panels so that water which may have accumulated during transit or storage, drains off. Do not store panels in contact with materials that might cause staining. Inspect panels upon arrival at jobsite; if wet, remove moisture, and restack and protect panels until used.

1.7 Warranty

According to contract.

PART 2 PRODUCTS

2.1 ROOFING AND SIDING PANELS

Roof and wall panels shall be steel and shall have a factory color finish meeting the specified requirements. Length of sheets shall be sufficient to cover when such dimension is 8800 millimeters, or less. When length of run at roof exceeds 8800 millimeters, each sheet in the run shall extend over two or more spans. Sheets may be longer than 8800 millimeters if approved by the Contracting Officer. Design provisions shall be made for expansion and contraction. Thickness of sheet for panels shall be not less than specified. Where gages are specified, gages are subject to normal manufacturing tolerances.

- a. Insulated roof panel (structural) to be 200 mm thickness, provided by DC Insulation A/S or approved equal.
- b. Applied Roofing: Corrugated metal sheathing (sheet) applied over insulated roof panel to be 79 mm. Refer to detail 1-3 of sheet A-503 for sheathing profile requirements.
- c. Insulated wall panel (structural) and insulated panel (structural) applied to underside of level 1 as depicted on sheet A-104 to be 150 mm thickness, provided by DC Insulation A/S or approved equal.

2.1.1 Coated Steel Panels

2.1.1.1 Material and Coating

Form sheets from steel conforming to ASTM A 653/A 653M, Structural Grade 40, galvanized coating conforming to ASTM A 924/A 924M, Class Z275.

2.1.1.2 Gage

In no case lighter than required to meet maximum deflection requirements specified.

2.1.1.3 Factory Color Finish

Provide factory applied, baked coating to the exterior and interior of metal roof and wall panels and metal accessories. Provide exterior finish top coat of Hairexcel Granite at exterior side of corrugated roof plates with not less than 0.025 mm dry film thickness and plastisol coating with not less than 200 my dry film thickness at exterior side of wall panels and subfloor panels. The wall and sub-floor panel colors shall be in accordance with A-2 series descriptions of the construction document drawings. The color designations shall match the blue, gray, and white panel color of the newly constructed Thule Clinic. Color designations shall be as follows:

Blue, Grey and White as depicted on Sheet A-203 and A-104 shall be: Blue- Blue Ciel 530 - NCS-4030-B, Grey- RAL 9002 - Light Grey, White- RAL 9010 - White, Colors provided by DC-Systems Insulation A/S.

The red designation shall match the color of the adjacent Building 100. Provide primer galvanization with not less than 275 g/m2 doubleside dry film thickness. Interior finish shall consist of the same coating and dry film thickness as the exterior coating. Provide exterior coating meeting the test requirements specified. Tests shall have been performed on the same factory finish and thickness provided.

2.1.2 Liner Panels

Formed of same material as wall panels.

2.1.3 Accessories

Provide sheet metal flashings, trim moldings, closure strips, caps, and other preformed metal panel accessories, of same material and finish as panels, except accessories that are concealed after installation, and are aluminum or zinc-coated steel may be provided unfinished. Provide metal thickness not less than that of panels. Provide molded closure strips of closed-cell or solid-cell synthetic rubber, neoprene, or polyvinyl chloride premolded to match configurations of preformed metal panels.

2.1.4 Fasteners

Provide fasteners for attaching panels to structural supports and to adjoining panels as approved and in accordance with printed manufacturer's recommendations; unless specified otherwise, fasteners shall be any of the following: self-tapping screws, bolts and nuts and self-locking rivets, self-locking bolts, end-welded studs, bolted or riveted studs, and stem rivets held by aluminum straps. Provide fastening system to withstand design loads indicated. Fasteners, except those having integral hexagonal washer heads and those having aluminum drive caps, shall have composite

metal and neoprene washers. Provide fasteners having integral hexagonal washer heads and fasteners having aluminum drive caps with polychloroprene washers.

2.1.4.1 Screws

Not less than 6 mm diameter self-tapping type or self-drilling and self-tapping type.

2.1.4.2 Powder-Actuated Fasteners

Provide type to be fastened with powder-actuated tools and with shank diameter of adequate size to support loads imposed.

2.1.4.3 Blind Rivets

Stainless steel with nominal 5 mm diameter shank or aluminum with nominal 5 mm diameter shank. Provide thread-stem-type rivets for other than fastening of trim. Close rivets with hollow stems.

2.1.4.4 Bolts

Minimum 6 mm diameter, shouldered or plain shank nuts.

2.1.5 Joint-Sealing Material

Compressible adhesive-cohesive butyl polyisobutylene rubber tape.

2.1.6 Insulation Material

- a. 37 kg/m³ polyurethane foam.
- b. Thermal conductivity: W
- c. ISO 2581: 0.021 mK
- d. Compression strength, 10% def. ISO 844: 180kPa
- e. Dimensional stability: ISO 2796: -30 degrees C=0.1%
+100 degrees C=0.4%
- f. Shear strength: ISO 1922: 12kPa
- g. Shearings modulus: ISO 1922, 1200kPa
- h. Adhesion steel/PU-foam
- i. ASTM 1623-78: 200kPa

PART 3 EXECUTION

3.1 INSTALLATION

In accordance with manufacturer's approved installation instructions, and approved drawings, except as specified otherwise. Install panels in full and firm contact with each other at side and end laps. Where panels are cut in field or where factory-applied coating is damaged and necessary repairs have been made with material of same type and color as finish coating, obtain approval of the Contracting Officer before installation. Correct defects in materials. Remove defective materials which cannot be corrected, and provide non-defective materials. Provide molded closure strips where indicated and whenever panels terminate with open ends after

installation.

3.1.1 Insulated Panels (Wall, Roof and Level 1 Underside)

Apply panels with longitudinal configurations in vertical position. Provide panels in full wall heights from base to eave with no horizontal joints except at junctions of door frames, window frames, louver panels, and similar locations. Seal side and end laps with joint-sealing material.

Flash seal walls at base and at top, around windows, door frames, framed louvers, and other similar openings. Place closures, flashing, and sealing materials to achieve complete water tightness. Flashing is not required where approved joints are used. The erection of the panels is primarily installed in a clockwise orientation. The metal in the joint at the panel-to-panel connection is to be thoroughly cleaned if required with a degreasing agent. The sealant is applied to the external and internal edge of the panel. Each panel is locked together with the adjacent panel utilizing the eccentric lock mechanism. Each panel to be locked completely tight enabling the sealant to appear the total length of the joint on the external and internal side of the panels. Surplus material should be removed on visible faces. Once panels have been locked together the cover plugs are placed in position. Before the panels in the corners are erected, through going steel sheet is removed. The connection is foamed using the spray foam according to the manufacturer's instruction. External and Internal corner angles and the L-membrane shall be fastened utilizing sealant and air tight pop rivets, maximum spacing of 200 mm on center.

3.1.2 Roof Panels

Apply roofing panels with longitudinal configurations in the direction of the roof slope. Provide roofing panels in longest lengths obtainable, with end laps occurring only at purlins and structural members to eaves, with no transverse joints. Lay side laps away from prevailing wind, and seal side and end laps with joint-sealing material. Flash seal roof at ridge, eaves, rakes, and at projections through roof. Provide closure strips, flashing, and sealing material to achieve complete weathertightness. Minimum end laps shall be 200 mm, shall occur only over purlins and structural members, and shall be aligned in a staggered pattern with adjoining panels. Side laps shall be standard overlap or interlocking rib based on manufacturer's standard.

3.1.3 Flashings

Provide flashings, related closures, and accessories provided with preformed metal panels where indicated to provide watertight installation. Install flashing, related closure, and accessories not indicated in accordance with panel manufacturer's printed instructions and details or approved shop drawings. Installation shall allow for expansion and contraction of flashing.

3.1.4 Fastener Installation

Provide fastener spacings in accordance with manufacturer's recommendations to withstand design loads indicated. Install fasteners in valleys or crowns in accordance with manufacturer's recommendations. Install

fasteners in straight lines within tolerance of 13 mm in length of bay. Drive exposed, penetrating-type fasteners normal to surface and to uniform depth to seat washers with gaskets. Drive so as not to damage factory-applied coating. Provide thermal space blocks at each fastener to provide thermal barrier and to eliminate condensation. Exercise extreme care when drilling pilot hole for fastenings to keep drills perpendicular and centered in valleys or crowns, as applicable. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Torque used when applying fasteners shall not exceed that recommended by manufacturer. Remove panels damaged by over-torqued fastenings, and provide new panels. Remove metal shavings and fillings from roofs upon completion to prevent rusting and discoloration of panels.

3.2 PROTECTION OF APPLIED ROOFING

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to indicated live load limits of roof construction.

3.3 CLEANING

Clean exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from roofs. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

3.4 INSULATED PANEL STORAGE

All materials are to be stored absolutely dry on a level a stable surface. If there is any risk of moisture or water on the storage area, the materials are to be placed elevated from the ground on suitable supports, to prevent moisture and water from reaching the materials. If possible, all materials are to be stored under a roof in a ventilated area. If that is not possible, tarpaulins should cover the materials to protect against rain- and sun radiation. Tarpaulin placement should allow for enough ventilation to prevent condensation on panel surface. Following any rainfall the tarpaulins shall be removed for several hours.

3.4.1 Prefabricated Insulated Panel Storage

The panels are to be stored lying on the flat side with the shipped filling pieces retained until panel is installed. All requirements described above for general DC Panel storage shall also apply for the Prefabricated Insulated Panel Storage.

3.4.2 Foam Storage

One component spray foam supplied in small bottles shall be stored in a dry area with temperatures not to exceed 40 C° - 50 C°. The lifetime of the bottles is 6-9 months from date of manufacturing. The bottles are to be

stored standing upright.

3.4.3 Door Storage

Doors to be placed in dry area with temperatures never to exceed 50 C° measured on door surface. Polystyrene blocks are recommended for intermediary layer/stress distribution. Before placement, any cardboard, paper and especially tape must be removed, as these materials under adverse circumstances may cause surface discolouring. The same storage method must be used for frames.

3.4.4 Profiled Wall and Roof Plates

Steel- or aluminium plates are to be stored under cover in a dry space in storage as well as in erection period. Small parts should be left unpacked as long as possible. Boxes with metal plates must be stacked max. 3 colli high.

Unpacked plates are to be stored in the following way:

- a. Never put more than 40 plates on top of another.
- b. Do not remove plastic foil between the plates.
- c. The stacks are to be supported at least 10 cm, above ground level.
The support should be approx. 20 cm from the ends of the plates and with a distance not exceeding 75cm.
- d. If the plates are to be stored outside they are to be covered with tarpaulins or plastic. The covering shall allow for ventilation between the bottom plate and the ground.
- e. The materials are to be stored with a slope to allow for condensation to run off. Incorrect storage procedures may result in permanent damage to the plates.

-- End of Section --

SECTION 07840

FIRESTOPPING
06/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 119	(2000a) Fire Tests of Building Construction and Materials
ASTM E 1399	(1997; R 2000) Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
ASTM E 1966	(2001) Fire-Resistive Joint Systems
ASTM E 814	(2002) Fire Tests of Through-Penetration Fire Stops
ASTM E 84	(2003) Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM P7825a	(2003) Approval Guide Fire Protection
FM Standard 4991	(2001) Approval of Firestop Contractors

UNDERWRITERS LABORATORIES (UL)

UL 1479	(2003) Fire Tests of Through-Penetration Firestops
UL 2079	(1998) Tests for Fire Resistance of Building Joint Systems
UL 723	(1996; Rev thru Sep 2001) Test for Surface Burning Characteristics of Building Materials
UL Fire Resist Dir	(2003) Fire Resistance Directory (Vol 1, 2A, 2B & 3)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping Materials.

Detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resist Dir or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgement, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal shall indicate the firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are to receive firestopping, provide drawings that indicate location, "F" and "T" ratings, and type of application.

SD-07 Certificates

Firestopping Materials.

Certificates attesting that firestopping material complies with the specified requirements. In lieu of certificates, drawings showing UL classified materials as part of a tested assembly may be provided. Drawings showing evidence of testing by an alternate nationally recognized independent laboratory may be substituted.

Installer Qualifications.

Documentation of training and experience.

Inspection.

Manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

1.3 GENERAL REQUIREMENTS

Firestopping shall consist of furnishing and installing tested and listed firestop systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the

integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint. Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above.

1.4 DELIVERY AND STORAGE

Materials shall be delivered in the original unopened packages or containers showing name of the manufacturer and the brand name. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

1.5 INSTALLER QUALIFICATIONS

The Contractor shall engage an experienced Installer who is:

- a. FM Research approved in accordance with FM Standard 4991, or
- b. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer qualification on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures.

1.6 COORDINATION

The specified work shall be coordinated with other trades. Firestopping materials, at penetrations of pipes and ducts, shall be applied prior to insulating, unless insulation meets requirements specified for firestopping. Firestopping materials at building joints and construction gaps shall be applied prior to completion of enclosing walls or assemblies.

Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible.

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS

Firestopping materials shall consist of commercially manufactured, asbestos-free, containing no water soluble intumescent ingredients, noncombustible products FM P7825a approved for use with applicable construction and penetrating items, complying with the following minimum

requirements:

2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resist Dir or by a nationally recognized testing laboratory.

2.1.2 Toxicity

Material shall be nontoxic to humans at all stages of application or during fire conditions.

2.1.3 Fire Resistance Rating

Firestop systems shall be UL Fire Resist Dir listed or FM P7825a approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected, except that "F" rating may be 3 hours in through-penetrations of 4 hour fire rated wall or floor. Firestop systems shall also have "T" rating where required.

2.1.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph GENERAL REQUIREMENTS, shall provide "F" and "T" fire resistance ratings in accordance with ASTM E 814 or UL 1479. Fire resistance ratings shall be as follows:

- a. Penetrations of Fire Resistance Rated Walls and Partitions: F Rating of wall or partition being penetrated.
- b. Penetrations of Fire Resistance Rated Floors, Floor-Ceiling Assemblies and the ceiling membrane of Roof-Ceiling Assemblies: F Rating = 1 hour, T Rating = 1 hour.

2.1.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph GENERAL REQUIREMENTS, and gaps such as those between floor slabs or roof decks and curtain walls shall be the same as the construction in which they occur. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested per ASTM E 119, ASTM E 1966 or UL 2079 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E 1399 or UL 2079.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal

deck to receive device prior to concrete placement shall be sound and capable of supporting device. Surfaces shall be prepared as recommended by the manufacturer.

3.2 INSTALLATION

Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 100 mm or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Firestopping shall be installed in accordance with manufacturer's written instructions. Tested and listed firestop systems shall be provided in the following locations, except in floor slabs on grade:

- a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.
- b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
- c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.
- d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
- e. Construction joints in floors and fire rated walls and partitions.
- f. Other locations where required to maintain fire resistance rating of the construction.

3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Thermal insulation shall be replaced with a material having equal thermal insulating and firestopping characteristics.

3.2.2 Fire Dampers

Fire dampers shall be installed and firestopped in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.2.3 Data and Communication Cabling

Cabling for data and communication applications shall be sealed with re-enterable firestopping products that do not cure over time. Firestopping shall be modular devices, containing built-in self-sealing intumescent inserts. Firestopping devices shall allow for cable moves, adds or changes without the need to remove or replace any firestop materials.

3.3 INSPECTION

For all projects, the firestopped areas shall not be covered or enclosed until inspection is complete and approved by the manufacturer's technical representative. The manufacturer's representative shall inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements. The Contractor shall submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; type shall be recorded by UL listed printed numbers.

-- End of Section --

SECTION 07920

JOINT SEALANTS

10/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 509	(2000) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C 570	(2000) Oil- and Resin-Base Caulking Compound for Building Construction
ASTM C 734	(2001) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C 919	(2002) Use of Sealants in Acoustical Applications
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 1056	(2000) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1667	(1997) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam)
ASTM D 217	(2002) Cone Penetration of Lubricating Grease
ASTM E 84	(2003) Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants

Primers

Bond breakers

Backstops

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). A copy of the Material Safety Data Sheet shall be provided for each solvent, primer or sealant material.

SD-07 Certificates

Sealant

Certificates of compliance stating that the materials conform to the specified requirements.

1.3 ENVIRONMENTAL CONDITIONS

The ambient temperature shall be within the limits of 4 and 32 degrees C when sealant is applied.

1.4 DELIVERY AND STORAGE

Deliver materials to the job site in unopened manufacturers' external shipping containers, with brand names, date of manufacture, color, and material designation clearly marked thereon. Elastomeric sealant containers shall be labeled to identify type, class, grade, and use. Carefully handle and store materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 32 degrees C or less than 4 degrees C.

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant that has been tested and found suitable for the substrates to which it will be applied.

2.1.1 Interior Sealant

ASTM C 920, Type S or M, Grade NS, Class 12.5, Use NT. Location(s) and color(s) of sealant shall be as follows:

LOCATION	COLOR
a. Small voids between walls or partitions and adjacent lockers, casework, shelving, door frames, built-in or surface-mounted equipment and fixtures, and similar items.	

LOCATION	COLOR
b. Joints between edge members for acoustical tile and adjoining vertical surfaces.	White
c. Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.	White
d. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where nonplaner tile surfaces meet.	White
e. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change. Refer to 09915 - Color Schedule.	As selected. Will match adjacent materials.
f. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.	White

2.1.2 Exterior Sealant

For joints in vertical surfaces, provide ASTM C 920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C 920, Type S or M, Grade P, Class 25, Use T. Location(s) and color(s) of sealant shall be as follows:

LOCATION	COLOR
a. Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	Match adjacent surface color
b. Voids where items pass through exterior walls.	Match adjacent surface
c. Metal-to-metal joints where sealant is indicated or specified. Note: The substrate for this application will be galvanized steel insulated panels with polyester paint. Exterior sealant must be able to maintain their intended characteristics at -60 degrees F.	Match adjacent surface
d. Joints between ends of gravel stops, fascias, copings, and adjacent walls.	Match adjacent surface

2.1.3 Floor Joint Sealant

ASTM C 920, Type S or M, Grade P, Class 25, Use T. Location(s) and color(s) of sealant shall be as follows:

LOCATION	COLOR
a. Seats of metal thresholds for exterior doors.	As selected
b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.	Match adjacent surface

2.1.4 Acoustical Sealant

Rubber or polymer-based acoustical sealant conforming to ASTM C 919 shall have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84. Acoustical sealant shall have a consistency of 250 to 310 when tested in accordance with ASTM D 217, and shall remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C 734, and shall be non-staining.

2.1.5 Preformed Sealant

Preformed sealant shall be polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealant capable of sealing out moisture, air and dust when installed as recommended by the manufacturer. At temperatures from minus 34 to plus 71 degrees C , the sealant shall be non-bleeding and shall have no loss of adhesion.

2.1.5.1 Tape

Tape sealant: cross-section dimensions shall be.

2.1.5.2 Bead

Bead sealant: cross-section dimensions shall be 12 mm.

2.1.5.3 Foam Strip

Foam strip shall be polyurethane foam; cross-section dimensions shall be 25 mm. Foam strip shall be capable of sealing out moisture, air, and dust when installed and compressed as recommended by the manufacturer. Service temperature shall be minus 40 to plus 135 degrees C . Untreated strips shall be furnished with adhesive to hold them in place. Adhesive shall not stain or bleed into adjacent finishes. Treated strips shall be saturated with butylene waterproofing or impregnated with asphalt.

2.2 PRIMERS

Provide a nonstaining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

2.3 BOND BREAKERS

Provide the type and consistency recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

2.4 BACKSTOPS

Provide glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Backing shall be 25 to 33 percent oversize for closed cell and 40 to 50 percent oversize for open cell material, unless otherwise indicated. Backstop material shall be compatible with sealant. Do not use oakum and other types of absorptive materials as backstops.

2.4.1 Rubber

Cellular rubber sponge backing shall be ASTM D 1056, Type 1, open cell, or Type 2, closed cell, Class A, Grade , round cross section.

2.4.2 PVC

Polyvinyl chloride (PVC) backing shall be ASTM D 1667, Grade VO 12, open-cell foam, round cross section.

2.4.3 Synthetic Rubber

Synthetic rubber backing shall be ASTM C 509, Option I, Type I preformed rods.

2.4.4 Neoprene

Neoprene backing shall be ASTM D 1056, closed cell expanded neoprene cord Type 2, Class C, Grade.

2.5 CAULKING

Oil- and resin-based caulking shall be ASTM C 570, Type 0 for exterior wall panels.

2.6 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer except for aluminum and bronze surfaces that will be in contact with sealant.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces shall be clean, dry to the touch, and free from dirt frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths. When resealing an existing joint, remove existing calk or sealant prior to applying new sealant. For surface types not listed below, the sealant

manufacturer shall be contacted for specific recommendations.

3.1.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue-free solvent.

3.1.2 Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. For removing protective coatings and final cleaning, use nonstaining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

3.1.3 Wood Surfaces

Wood surfaces to be in contact with sealants shall be free of splinters and sawdust or other loose particles.

3.2 SEALANT PREPARATION

Do not add liquids, solvents, or powders to the sealant. Mix multicomponent elastomeric sealants in accordance with manufacturer's instructions.

3.3 APPLICATION

3.3.1 Joint Width-To-Depth Ratios

a. Acceptable Ratios:

<u>JOINT WIDTH</u>	<u>JOINT DEPTH</u>	
	Minimum	Maximum
For metal, glass, or other nonporous surfaces:		
6 mm (minimum)	6 mm	6 mm
over 6 mm	1/2 of width	Equal to width

- b. Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding shall not be required on metal surfaces.

3.3.2 Masking Tape

Masking tape may be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant

smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

3.3.3 Backstops

Install backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide a joint of the depth specified. Install backstops in the following locations:

- a. Where indicated.
- b. Where backstop is not indicated but joint cavities exceed the acceptable maximum depths specified in paragraph entitled, "Joint Width-to-Depth Ratios."

3.3.4 Primer

Immediately prior to application of the sealant, clean out loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's instructions. Do not apply primer to exposed finish surfaces.

3.3.5 Bond Breaker

Provide bond breakers to the back or bottom of joint cavities, as recommended by the sealant manufacturer for each type of joint and sealant used, to prevent sealant from adhering to these surfaces. Carefully apply the bond breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond breaker.

3.3.6 Sealants

Provide a sealant compatible with the material(s) to which it is applied. Do not use a sealant that has exceeded shelf life or has jelled and can not be discharged in a continuous flow from the gun. Apply the sealant in accordance with the manufacturer's instructions with a gun having a nozzle that fits the joint width. Force sealant into joints to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Sealant shall be uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply sealant, and tool smooth as specified. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

3.4 PROTECTION AND CLEANING

3.4.1 Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

3.4.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains

and leave the work in a clean and neat condition.

- a. Masonry and Other Porous Surfaces: Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding.
- b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent-moistened cloth.

-- End of Section --

SECTION 08110

STEEL DOORS AND FRAMES

05/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|-------------|--|
| ANSI A250.3 | (1999) Test Procedure and Acceptance
Criteria for Factory Applied Finish
Painted Steel Surfaces for Steel Doors and
Frames |
| ANSI A250.4 | (2001) Test Procedure and Acceptance
Criteria for Physical Endurance for Steel
Doors, Frames, Frame Anchors and Hardware
Reinforcings |
| ANSI A250.6 | (1997) Hardware on Steel Doors
(Reinforcement - Application) |

ASTM INTERNATIONAL (ASTM)

- | | |
|-------------------|--|
| ASTM A 653/A 653M | (2003) Steel Sheet, Zinc-Coated
(Galvanized) or Zinc-Iron Alloy-Coated
(Galvannealed) by the Hot-Dip Process |
| ASTM A 924/A 924M | (1999) General Requirements for Steel
Sheet, Metallic-Coated by the Hot-Dip
Process |
| ASTM C 578 | (2003a) Rigid, Cellular Polystyrene
Thermal Insulation |
| ASTM C 59/C 59M1 | (2001) Unfaced Preformed Rigid Cellular
Polyisocyanurate Thermal Insulation |
| ASTM C 612 | (2000a) Mineral Fiber Block and Board
Thermal Insulation |
| ASTM D 2863 | (2000) Measuring the Minimum Oxygen
Concentration to Support Candle-Like
Combustion of Plastics (Oxygen Index) |

ASTM E 283 (1991; R 1999) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A115 (Set - Spec dates Vary) Steel Preparation Standards (Incl A115.1 (1990), A115.2 (1987), A115.4 (1994), A115.5 (1992), A115.6 (1993), A115.12 (1994), A115.13 (1991), A115.14 (1994), A115.15 (1994), A115.16 (1990), A115.17 (1994), A115.18 (1994))

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 105 (2003) Installation of Smoke Door Assemblies

NFPA 252 (2003) Fire Tests of Door Assemblies

NFPA 80 (1999) Fire Doors and Fire Windows

STEEL DOOR INSTITUTE (SDI)

SDI 105 (2001) Recommended Erection Instructions for Steel Frames

SDI 111-F (2000) Recommended Existing Wall Anchors for Standard Steel Doors and Frames

SDI 113 (2001) Determining the Steady State Thermal Transmittance of Steel Door and Frame Assemblies

SDI A250.8 (2003) Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES (UL)

UL 10B (1997; Rev thru Oct 2001) Fire Tests of Door Assemblies

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors; G

Frames; G

Accessories

Weatherstripping

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

Schedule of doors; G

Schedule of frames; G

Submit door and frame locations.

SD-03 Product Data

Doors; G

Frames; G

Accessories

Weatherstripping

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction. When "custom hollow metal doors" are provided in lieu of "standard steel doors," provide additional details and data sufficient for comparison to SDI A250.8 requirements.

SD-04 Samples

Factory-applied enamel finish; G

Where colors are not indicated, submit manufacturer's standard colors and patterns for selection.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Strap knock-down frames in bundles. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 6 mm airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

SDI A250.8, except as specified otherwise. Prepare doors to receive hardware specified in Section 08710 DOOR HARDWARE. Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Interior doors shall be minimum 40 mm thick, and exterior doors 68 mm thick unless otherwise indicated. Refer to drawings for door schedule. Doors to be Hansendoor or approved equal.

2.1.1 Classification - Level, Performance, Model

2.1.1.1 Standard Duty Doors

SDI A250.8, Level 1, physical performance Level C, Model size and design indicated and core construction as required by the manufacturer.

2.1.1.2 Heavy Duty Doors

SDI A250.8, Level 2, physical performance Level B, Model with core construction as required by the manufacturer for exterior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation. Provide Level II where indicated on drawings.

2.2 INSULATED STEEL DOOR SYSTEMS

Contractor to use Hansendoor System or approved equal. Insulated steel doors and frames may be provided in lieu of Grade I standard steel doors and frames. Door size(s), design, and material shall be as specified for standard steel doors. Insulated steel doors shall have a core of polyurethane foam and an R factor of 10.0 or more (based on a k value of 0.16); face sheets, edges, and frames of galvanized steel not lighter than 0.7 mm thick, 1.5 mm thick, and 1.5 mm respectively; magnetic weatherstripping; nonremovable-pin hinges; thermal-break aluminum threshold; and vinyl door bottom. Doors and frames shall receive phosphate treatment, rust-inhibitive primer, and baked acrylic enamel finish. Doors shall have been tested in accordance with ANSI A250.4 and shall have met the requirements for Level C. Prepare doors to receive hardware specified in Section 08710 DOOR HARDWARE. Doors shall be 44.5 mm thick. Provide insulated steel doors and frames at all entrances to dormitory.

2.3 SOUND RATED STEEL DOORS

Doors shall be of the sound classification scheduled.

2.4 ACCESSORIES

2.4.1 Astragals

For pairs of exterior steel doors which will not have aluminum astragals or removable mullions, as specified in Section 08710 DOOR HARDWARE, provide

overlapping steel astragals with the doors. For interior pairs of fire rated and smoke control doors, provide stainless steel astragals complying with NFPA 80 for fire rated assemblies and NFPA 105 for smoke control assemblies.

2.4.2 Moldings

Provide moldings around glass of interior and exterior doors and louvers of interior doors. Provide nonremovable moldings on outside of exterior doors and on corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to stationary moldings, or provide snap-on moldings. Muntins shall interlock at intersections and shall be fitted and welded to stationary moldings.

2.5 INSULATION CORES

Insulated cores shall be of type specified, and provide an apparent U-factor of .48 in accordance with SDI 113 and shall conform to:

- a. Rigid Polyurethane Foam: ASTM C 59/C 59M1, Type 1 or 2, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with ASTM D 2863; or
- b. Rigid Polystyrene Foam Board: ASTM C 578, Type I or II; or
- c. Mineral board: ASTM C 612, Type I.

2.6 STANDARD STEEL FRAMES

SDI A250.8, except as otherwise specified. Form frames to sizes and shapes indicated, with knock-down field-assembled corners. Provide steel frames for doors, mullions, cased openings, and interior glazed panels, unless otherwise indicated.

2.6.1 Knock-Down Frames - For Interior Doors

Design corners for simple field assembly by concealed tenons, splice plates, or interlocking joints that produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for bolted connections.

2.6.2 Mullions and Transom Bars

Mullions and transom bars shall be closed or tubular construction and shall member with heads and jambs butt-welded thereto or knock-down for field assembly. Bottom of door mullions shall have adjustable floor anchors and spreader connections.

2.6.3 Stops and Beads

Form stops and beads from 0.9 mm thick steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 300 to 400 mm on centers. Miter

molded shapes at corners. Butt or miter square or rectangular beads at corners.

2.6.4 Terminated Stops

Interior door frames stops in floor level on the plywood. Interior door leaves are to be as indicated in door schedule.

Stops of door leaves for soundrated doors in accordance to schedule.

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

2.6.5 Cased Openings

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

2.6.6 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 1.2 mm thick.

2.6.6.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 2285 mm in height, provide one additional anchor for each jamb for each additional 760 mm or fraction thereof.

- a. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to wood studs with nails;
- b. Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with SDI 111-F; and

2.6.6.2 Floor Anchors

Provide floor anchors drilled for 10 mm anchor bolts at bottom of each jamb member.

2.7 FIRE AND SMOKE DOORS AND FRAMES

NFPA 80 and NFPA 105 and this specification. The requirements of NFPA 80 and NFPA 105 shall take precedence over details indicated or specified.

2.7.1 Labels

Fire doors and frames shall bear the label of Underwriters Laboratories (UL), Factory Mutual Engineering and Research (FM), Warnock Hersey International (WHI), or approved equal Danish marking attesting to the

rating required. Testing shall be in accordance with NFPA 252 or UL 10B. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted.

2.7.2 Astragal on Fire and Smoke Doors

On pairs of labeled fire doors, conform to NFPA 80 and UL requirements.

2.8 WEATHERSTRIPPING

As specified in Section 08710 DOOR HARDWARE.

2.8.1 Integral Gasket

Black synthetic rubber gasket with tabs for factory fitting into factory slotted frames, or extruded neoprene foam gasket made to fit into a continuous groove formed in the frame, may be provided in lieu of head and jamb seals specified in Section 08710 DOOR HARDWARE. Insert gasket in groove after frame is finish painted. Air leakage of weatherstripped doors shall not exceed 2.19 by 10⁻⁵ cubic meters per second of air per square meter of door area when tested in accordance with ASTM E 283.

2.9 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in ANSI A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI A250.8 and ANSI A250.6. For additional requirements refer to BHMA A115.

Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI A250.8, as applicable. Punch door frames, with the exception of frames that will have weatherstripping or soundproof gasketing, to receive a minimum of three rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

2.10 FINISHES

2.10.1 Factory-Primed Finish

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in SDI A250.8. Where coating is removed by welding, apply touchup of factory primer.

2.10.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate exterior doors and frames from hot dipped zinc coated steel, alloyed type, that complies with ASTM A 924/A 924M and ASTM A 653/A 653M. The Coating weight shall meet or exceed the minimum requirements for coatings having 122 grams per square meter, total both sides, i.e., ZF120.

Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in SDI A250.8.

2.10.3 Factory-Applied Enamel Finish

Coatings shall meet test procedures and acceptance criteria in accordance with ANSI A250.3. After factory priming, apply two coats of medium-gloss enamel to exposed surfaces. Separately bake or oven dry each coat. Drying time and temperature requirements shall be in accordance with the coating manufacturer's recommendations. Color(s) of finish coat shall be as indicated in color schedule.

2.11 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Frames

Set frames in accordance with SDI 105. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Backfill frames with mortar. When an additive is provided in the mortar, coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

3.1.2 Doors

Hang doors in accordance with clearances specified in SDI A250.8. After erection and glazing, clean and adjust hardware.

3.1.3 Fire and Smoke Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80. Install fire rated smoke doors and frames in accordance with NFPA 80 and NFPA 105.

3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same

type used for shop coat.

3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

3.4 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements are as follows:

<u>PRODUCTS</u>	<u>INCH-POUND</u>	<u>METRIC</u>
Door thickness	1 3/4 inches	44.5 mm
Steel channels	16 gage	1.5 mm
Steel Sheet	23 gage	0.7 mm
	16 gage	1.5 mm
	20 gage	0.9 mm
	18 gage	1.2 mm
Anchor bolts	3/8 inches	10 mm

-- End of Section --

SECTION 08210

WOOD DOORS

09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI Qual Stds (2003) AWI Quality Standards

ASTM INTERNATIONAL (ASTM)

ASTM E 90 (2002) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3 (2000) High-Pressure Decorative Laminates

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

WDMA I.S. 1-A (1997) Architectural Wood Flush Doors

WDMA I.S. 4 (2000) Water-Repellent Preservative Non-Pressure Treatment for Millwork

WDMA TM-5 (1990) Split Resistance Test Method

WDMA TM-7 (1990) Cycle Slam Test Method

WDMA TM-8 (1990) Hinge Loading Test Method

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors; G

Submit drawings or catalog data showing each type of door unit; descriptive data of head and jamb weatherstripping with installation instructions shall be included. Drawings and data shall indicate door type and construction, sizes, thickness, methods of assembly, door louvers, and glazing.

SD-03 Product Data

Doors; G

Accessories

Water-resistant sealer

Sample warranty

Sound transmission class rating; G

Fire resistance rating; G

SD-04 Samples

Doors

Prior to the delivery of wood doors, submit a sample section of each type of door which shows the stile, rail, veneer, finish, and core construction.

Door finish colors; G

Refer to 2.2.5.4 of Section 09915 (Color Schedule).

SD-06 Test Reports

Split resistance

Cycle-slam

Hinge loading resistance

Submit split resistance test report for doors tested in accordance with WDMA TM-5, cycle-slam test report for doors tested in accordance with WDMA TM-7, and hinge loading resistance test report for doors tested in accordance with WDMA TM-8.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors to the site in an undamaged condition and protect against damage and dampness. Stack doors flat under cover. Support on blocking, a minimum of 100 mm thick, located at each end and at the midpoint of the door. Store doors in a well-ventilated building so that they will not be exposed to excessive moisture, heat, dryness, direct sunlight, or extreme changes of temperature and humidity. Do not store in a building under

construction until concrete, and plaster are dry. Replace defective or damaged doors with new ones.

1.4 WARRANTY

Warranty shall warrant doors free of defects as set forth in the door manufacturer's standard door warranty.

PART 2 PRODUCTS

2.1 DOORS

Provide doors of the types, sizes, and designs indicated. Doors to be manufactured by Sweedoor-Jutlandia, www.swedoor-jutlandia.dk, Other comparable Door manufacturers may be considered as an "Approved Substitute". However, any approved substitute must be comparable in quality to the AWI, ASTM and WDMA standards stipulated in this specification section and must also meet the approval of the Contracting Officer.

2.1.1 Flush Doors

Flush doors shall conform to WDMA I.S. 1-A. Hollow core doors shall have lock blocks and 25 mm minimum thickness hinge stile. Stile edge bands of doors to receive natural finish shall be hardwood, compatible with face veneer. Stile edge bands of doors to be painted shall be mill option specie. No visible finger joints will be accepted in stile edge bands. When used, locate finger-joints under hardware.

2.1.1.1 Interior Flush Doors

Provide solid core, Type II flush doors conforming to WDMA I.S. 1-A with faces of sound grade hardwood or hardboard for painted finish good red birch. Hardwood veneers shall be plain sliced.

2.1.2 Acoustical Doors

WDMA I.S. 1-A, solid core, constructed to provide Sound Transmission Class rating of 35 when tested in accordance with ASTM E 90.

2.1.3 Prehung Doors

Frames for prehung interior doors to be for clear finish, with 3 piece adjustable jamb units. Provide doors as specified complete with frame, hinges, and prepared to receive finish hardware.

2.2 ACCESSORIES

2.2.1 Door Louvers

Fabricate from wood and of sizes indicated. Louvers shall be of the manufacturer's standard design and shall transmit a minimum of 35 percent free air. Louvers shall be the sightproof inverted vee slat type. Mount louvers in the door as indicated with flush wood moldings.

2.2.2 Door Light Openings

Provide glazed openings with the manufacturer's standard wood moldings. Moldings on exterior doors shall have sloped surfaces. Moldings for flush doors shall be lip type. Provide glazed openings in fire-rated doors with fire rated frames. Glazing is specified in Section 08800 GLAZING.

2.2.3 Weatherstripping

Refer to Section 08710.

2.2.4 Additional Hardware Reinforcement

Provide fire rated doors with hardware reinforcement blocking. Size of lock blocks shall be as required to secure the hardware specified. Top, bottom and intermediate rail blocks shall measure 125 mm minimum by full core width. Reinforcement blocking shall be in compliance with the manufacturer's labeling requirements and shall not be mineral material similar to the core.

2.3 FABRICATION

2.3.1 Marking

Each door shall bear a stamp, brand, or other identifying mark indicating quality and construction of the door.

2.3.2 Quality and Construction

Identify the standard on which the construction of the door was based, identify the standard under which preservative treatment was made, and identify doors having a Type I glue bond.

2.3.3 Preservative Treatment

Exterior doors shall be water-repellent preservative treated and so marked at the plant in accordance with WDMA I.S. 4.

2.3.4 Adhesives and Bonds

WDMA I.S. 1-A. Use Type I bond for exterior doors and Type II bond for interior doors. Adhesive for doors to receive a natural finish shall be nonstaining.

2.3.5 Prefitting

At the Contractor's option, doors may be provided factory pre-fit. Doors shall be sized and machined at the factory by the door manufacturer in accordance with the standards under which they are produced. The work shall include sizing, bevelling edges, mortising, and drilling for hardware and providing necessary beaded openings for glass and louvers. Provide the door manufacturer with the necessary hardware samples, and frame and hardware schedules as required to coordinate the work.

2.3.6 Finishes

2.3.6.1 Field Painting

Factory prime or seal doors, and field paint as specified in Section 09900 PAINTS AND COATINGS.

2.3.6.2 Factory Finish

Provide doors finished at the factory by the door manufacturer as follows: AWI Qual Stds Section 1500, specification for System No. 4 Conversion varnish alkyd urea or System No. 5 Vinyl catalyzed. The coating shall be AWI Qual Stds premium, medium rubbed sheen, closed grain effect. Use stain when required to produce the finish specified for color. Seal edges, cutouts, trim, and wood accessories, and apply two coats of finish compatible with the door face finish. Touch-up finishes that are scratched or marred, or where exposed fastener holes are filled, in accordance with the door manufacturer's instructions. Match color and sheen of factory finish using materials compatible for field application.

2.3.6.3 Plastic Laminate Finish

Factory applied, NEMA LD 3, General or Specific purpose type, 1.25 mm minimum thickness. Glue laminated plastic for hollow core doors to wood veneer, plywood, or hardboard backing to form door panel. Combined minimum thickness of laminate sheet and backing shall be 2.5 mm.

2.3.6.4 Color

Provide door finish colors as indicated. Refer to Section 09915 - Color Schedule.

2.3.7 Water-Resistant Sealer

Provide a water-resistant sealer compatible with the specified finishes as approved and as recommended by the door manufacturer.

2.4 SOURCE QUALITY CONTROL

Stiles of "B" and "C" label fire doors utilizing standard mortise leaf hinges shall meet the following performance criteria:

- a. Split resistance: Average of ten test samples shall be not less than 225 kilograms load when tested in accordance with WDMA TM-5.
- b. Cycle-slam: 200,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with the requirements of WDMA TM-7.
- c. Hinge loading resistance: Average of ten test samples shall be not less than 315 kilograms load when tested for direct screw withdrawal in accordance with WDMA TM-8 using a No. 12, 30 mm long, steel, fully threaded wood screw. Drill 4 mm pilot hole, use

40 mm opening around screw for bearing surface, and engage screw full, except for last 3 mm. Do not use a steel plate to reinforce screw area.

PART 3 EXECUTION

3.1 INSTALLATION

Before installation, seal top and bottom edges of doors with the approved water-resistant sealer. Seal cuts made on the job immediately after cutting using approved water-resistant sealer. Fit, trim, and hang doors with a 2 mm minimum, 3 mm maximum clearance at sides and top, and a 5 mm minimum, 6 mm maximum clearance over thresholds. Provide 10 mm minimum, 11 mm maximum clearance at bottom where no threshold occurs. Bevel edges of doors at the rate of 3 mm in 50 mm. Door warp shall not exceed 6 mm when measured in accordance with WDMA I.S. 1-A.

3.1.1 Prehung Doors

Install doors in accordance with the manufacturer's instructions and details. Provide fasteners for stops and casing trim within 75 mm of each end and spaced 275 mm on centers maximum. Provide side and head jambs joined together with a dado or notch of 5 mm minimum depth.

3.1.2 Weatherstripping

No exterior doors will be wood.

3.2 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements are as follows:

<u>PRODUCTS</u>	<u>INCH-POUND</u>	<u>METRIC</u>
Closet doors	1 1/8 inches	28.5 mm
	1 3/8 inches	35 mm

-- End of Section --

SECTION 08560

PLASTIC WINDOWS
08/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101 (1999) Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors

ASTM INTERNATIONAL (ASTM)

ASTM D 4099 (1995) Poly(Vinyl Chloride) (PVC) Prime Windows and Sliding Glass Doors

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Windows; G

Indicate elevations of windows, full-size sections, thicknesses of PVC, reinforcing members, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, mullion details, method and materials for weatherstripping, material and method of attaching subframes, casings, trim, accessories, installation details, window flashings and other related items.

Schedule of windows; G

Submit with drawings indicating location of each window unit.

SD-03 Product Data

Windows; G

Hardware

Fasteners

Screens

Weatherstripping

Accessories

SD-04 Samples

Windows; G

Submit one full-size window of each type, complete with certification label indicating conformance to AAMA 101 or ASTM D 4099, glazing, hardware, anchors, and other accessories. Where screens or weatherstripping are required, fit sample windows with such items that are to be provided. After approval, install each sample in the work, clearly identified, and record its location.

SD-06 Test Reports

Windows; G

Submit for each window type attesting that identical or larger windows have been tested and meet the requirements specified herein for conformance to AAMA 101 or ASTM D 4099 and the specified minimum Condensation Resistance Factor (CRF).

SD-10 Operation and Maintenance Data

Windows, Data Package 1; G

Submit data package in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

1.3 QUALITY ASSURANCE

1.3.1 Labels

Each window unit shall bear a certification label from an independent, nationally recognized testing organization validating that the product complies with AAMA 101 for the type, grade, and performance class specified or that the product complies with ASTM D 4099 for the grade specified.

1.3.2 Certification

Certified test reports attesting that the window units meet the requirements of AAMA 101 or ASTM D 4099 as specified will be acceptable in lieu of product labeling or marking.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver windows to the project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the job site. Store windows and components out of contact with the ground, under a weathertight covering, to prevent bending, warping, or otherwise damaging the windows. Store windows and components so they will not have to be handled at minus 28 degrees C or colder. Repair damaged windows to an "as new" condition as approved. Provide new units if windows cannot be repaired.

1.5 PROTECTION

Protect finished surfaces during shipping and handling using the manufacturer's standard method, except do not apply coatings or lacquers on surfaces to receive caulking and glazing compounds.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR WINDOWS

Windows shall conform to AAMA 101 or ASTM D 4099 and to requirements specified herein. Provide windows of materials, types, grades, performance classes, combinations and sizes indicated or specified. Each window shall be a unit consisting of frame, sash, glass, hardware, mullions, trim, casing, weatherstripping, anchors and accessories complete. Design windows to accommodate glass, hardware, weatherstripping, and accessories to be furnished. Glass shall be factory installed.

2.2 MATERIALS

2.2.1 Windows

Provide PVC, reinforcing members, fasteners, hardware, weatherstripping, and anchors conforming to AAMA 101 or ASTM D 4099 and as specified herein.

2.2.2 Glass and Glazing

As specified in Section 08800 GLAZING.

2.2.3 Calking and Sealing

As specified in Section 07920 JOINT SEALANTS.

2.2.4 Accessories

As standard with the manufacturer and as specified herein.

2.3 WINDOW TYPES

Windows shall be of the following types, as indicated.

2.3.1 Casement Windows (Type A)

Shall be PRIMO type 4000 or approved equal. Ventilators shall be handle operated. Provide ventilators over 1675 mm high with two separate locking devices or a two-point locking device operated by rods from a single lever handle. Conceal rods where possible. Provide casement windows in combination with fixed windows specified below.

2.3.2 Fixed Windows (Type B)

Shall be PRIMO type 4000 or approved equal.

2.3.3 Turn Windows

Is to be as PRIMO System 4000 in accordance to details. Size and direction of openings in accordance to elevation plans.

2.3.3.1 Construction

Ventilators shall have one or more stabilizing arms attached to the frame when ventilator is opened from top. When ventilator is in the tilt-open position, stabilizing arms shall provide positive positioning of the ventilator.

2.3.3.2 Hardware

Equip each ventilator with one handle to provide both tilt and swing operation. The tilt or swing operation shall be individually selected and rendered operable starting only from the closed sash position. Provide a secondary locking device for each ventilator to prevent accidental swing operation.

2.3.3.3 Performance Requirements

Be able to withstand 2, 4kN/m² and U-value to be max 1, 5w/m²/k.

2.4 FABRICATION

Conform to AAMA 101 or ASTM D 4099 and to the requirements specified herein.

2.4.1 Subframes, Mullions and Transom Bars

Provide subframes, transom bars and mullions between multiple window units which meet the design pressure of 2.4 Kn per square meter. Fabricate mullions and transom bars in such a manner as to permit expansion and contraction between adjoining construction and window units and to form a weathertight joint. Provide mullion covers on the interior and exterior to completely close exposed joints and recesses between window units and to present a neat appearance.

2.4.2 Combination Windows

Windows provided in combination shall be the same grade and performance class and shall be factory assembled. Where factory assembly of individual

windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

2.4.3 Frames and Sash

2.4.3.1 Corners and Reinforcement

Corners of PVC frames and sashes shall be welded. Reinforce frames and sash as necessary to meet the requirements for the performance classes or grades specified herein.

2.4.3.2 Adjustability

Ventilating sash shall be adjustable vertically and horizontally to ensure smooth operation.

2.4.3.3 Provisions for Glazing

Design windows and rabbets suitable for glass thickness shown or specified. Design sash for outside double glazing and for securing glass with glazing gaskets.

2.4.4 Hardware

The item, type, and functional characteristics shall be the manufacturer's standard for the particular window type. Provide hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip operating ventilators with a lock or latching device which can be secured from the inside.

2.4.5 Weatherstripping

Provide for ventilating sections of windows to ensure a weathertight seal meeting the infiltration requirements specified in AAMA 101 or ASTM D 4099. Provide easily replaceable factory-applied weatherstripping.

2.4.6 Color

Window (PVC) color shall be white as RAL-color 9010. Color shall be integral or co-extruded to the PVC to prevent heat build-up.

2.4.7 Fasteners

Provide fastener types as standard with the window manufacturer for windows, trim, and accessories.

2.4.8 Accessories

Provide windows complete with clips, fins, anchors, and other appurtenances necessary for complete installation and proper operation.

2.4.8.1 Anchors

Provide concealed anchors of the type recommended by the window

manufacturer for the specific type of construction. Anchors and fasteners shall be compatible with the window and the adjoining construction. For each jamb 900 mm or longer, provide a minimum of three anchors located approximately 150 mm from each end and at midpoint. For jambs less than 900 mm long, provide two anchors.

PART 3 EXECUTION

3.1 INSTALLATION

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install windows in a manner that will prevent entrance of water and wind. Fasten hardware to windows.

3.1.1 Anchors and Fastenings

Secure units to each other, to masonry, and to other adjoining construction with clips, fins, screws, or other devices recommended by the window manufacturer.

3.2 ADJUSTING

After installation of windows and completion of glazing and field painting, adjust ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary.

3.3 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weatherstripping, and to prevent interference with operation of hardware. Replace stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

3.4 PROTECTION

Protect ventilators and operating parts against accumulation of dirt and building materials by keeping ventilators tightly closed and locked to frame.

-- End of Section --

SECTION 08710

DOOR HARDWARE

02/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.1	(2000) Butts and Hinges
BHMA A156.12	(1999) Interconnected Locks & Latches
BHMA A156.13	(2002) Mortise Locks & Latches, Series 1000
BHMA A156.15	(2001) Closer Holder Release Devices
BHMA A156.16	(2002) Auxiliary Hardware
BHMA A156.2	(1996) Bored and Preassembled Locks and Latches
BHMA A156.3	(2001) Exit Devices
BHMA A156.4	(2000) Door Controls - Closers
BHMA A156.5	(2001) Auxiliary Locks & Associated Products
BHMA A156.6	(2001) Architectural Door Trim
BHMA A156.7	(2003) Template Hinge Dimensions
BHMA A156.8	(2000) Door Controls - Overhead Holders and Holders

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2003) Life Safety Code
NFPA 80	(1999) Fire Doors and Fire Windows

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir	(2004) Building Materials Directory
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Hardware schedule; G

Keying system

SD-03 Product Data

Hardware items; G

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Hardware Schedule items, Data Package 1; G

Submit in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

Key bitting

1.3 HARDWARE SCHEDULE

Prepare and submit hardware schedule in the following form:

Hard- ware Item	Quan- tity	Size	Reference Publi- cation Type No.	Finish	Mfr. Name and Catalog No.	Key Con- trol Symbols	UL Mark (If fire rated and listed)	BHMA Finish Designa- tion
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1.4 KEY BITTING CHART REQUIREMENTS

Submit key bitting charts to the Contracting Officer prior to completion of the work. Include:

- Complete listing of all keys (AA1, AA2, etc.).
- Complete listing of all key cuts (AA1-123456, AA2-123458).
- Tabulation showing which key fits which door.

- d. Copy of floor plan showing doors and door numbers.
- e. Listing of 20 percent more key cuts than are presently required in each master system.

1.5 QUALITY ASSURANCE

1.5.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, and closers of one lock, hinge, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown in hardware schedule. Deliver permanent keys and removable cores to the Contracting Officer, either directly or by certified mail. Deliver construction master keys with the locks.

PART 2 PRODUCTS

2.1 TEMPLATE HARDWARE

Hardware to be applied to metal or to prefinished doors shall be made to template. Promptly furnish template information or templates to door and frame manufacturers. Template hinges shall conform to BHMA A156.7. Coordinate hardware items to prevent interference with other hardware.

2.2 HARDWARE FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of NFPA 80 for fire doors and NFPA 101 for exit doors, as well as to other requirements specified, even if such hardware is not specifically mentioned under paragraph entitled "Hardware Schedule." Such hardware shall bear the label of Underwriters Laboratories, Inc., and be listed in UL Bld Mat Dir or labeled and listed by another testing laboratory acceptable to the Contracting Officer.

2.3 HARDWARE ITEMS

Hinges, locks, latches, bolts, and closers shall be clearly and permanently marked with the manufacturer's name or trademark where it will be visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover.

2.3.1 Hinges

BHMA A156.1, 114 by 114 millimeters unless otherwise specified. Construct loose pin hinges for exterior doors and reverse-bevel interior doors so that pins will be nonremovable when door is closed. Other antifriction

bearing hinges may be provided in lieu of ball-bearing hinges.

2.3.2 Locks and Latches

2.3.2.1 Mortise Locks and Latches

BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. Provide mortise locks with escutcheons not less than 178 by 57 mm with a bushing at least 6 mm long. Cut escutcheons to suit cylinders and provide trim items with straight, beveled, or smoothly rounded sides, corners, and edges. Knobs and roses of mortise locks shall have screwless shanks and no exposed screws.

2.3.2.2 Bored Locks and Latches

BHMA A156.2, Series 4000, Grade 1.

2.3.2.3 Residential Bored Locks and Latches

BHMA A156.2, Series 4000, Grade 2. Locks for exterior doors shall have threaded roses or concealed machine screws.

2.3.2.4 Interconnected Locks and Latches

BHMA A156.12. Provide F96 or F97, unless otherwise specified.

2.3.3 Cylinders and Cores

Provide cylinders and cores for new locks, including locks provided under other sections of this specification. Cylinders shall be products of one manufacturer, and cores shall be the products of one manufacturer. Rim cylinders, mortise cylinders, and knobs of bored locksets shall have interchangeable cores which are removable by special control keys. Stamp each interchangeable core with a key control symbol in a concealed place on the core.

2.3.4 Keying System

Provide a grand master keying system.

2.3.5 Lock Trim

Cast, forged, or heavy wrought construction and commercial plain design.

2.3.5.1 Lever Handles

Provide lever handles where specified in paragraph entitled "Hardware Schedule". Lever handles for exit devices shall meet the test requirements of BHMA A156.13 for mortise locks. Lever handle locks shall have a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when a force in excess of that specified in BHMA A156.13 is applied to the lever handle. Lever handles shall return to within 13 mm of the door face.

2.3.6 Keys

Furnish one file key, one duplicate key, and one working key for each key change and for each master and grand master keying system. Furnish one additional working key for each lock of each keyed-alike group.

2.3.7 Door Bolts

BHMA A156.16. Provide dustproof strikes for bottom bolts, except for doors having metal thresholds. Automatic latching flush bolts: BHMA A156.3, Type 25.

2.3.8 Closers

BHMA A156.4, Series C02000, Grade 1, with PT 4C. Provide with brackets, arms, mounting devices, fasteners, full size covers, and other features necessary for the particular application. Size closers in accordance with manufacturer's recommendations. Provide manufacturer's 10 year warranty.

2.3.8.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation located to be visible after installation.

2.3.9 Overhead Holders

BHMA A156.8.

2.3.10 Closer Holder-Release Devices

BHMA A156.15.

2.3.11 Door Protection Plates

BHMA A156.6.

2.3.12 Door Stops and Silencers

BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each pair.

2.3.13 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, required to service and adjust hardware items.

2.4 FASTENERS

Provide fasteners of proper type, quality, size, quantity, and finish with hardware. Fasteners exposed to weather shall be of nonferrous metal or stainless steel. Provide fasteners of type necessary to accomplish a permanent installation.

2.5 FINISH HARDWARE DATA

2.5.1 Materials

The hardware model numbers in the following Class/Description 2.5.2 and the hardware schedule 3.5 are taken from the catalog information of the below "Listed" Manufacturers. For Competitive bidding, door hardware manufactured by Dline (www.dline.com) or other comparable Danish hardware products may be considered as an "Approved Substitute". However, any approved substitute must be comparable in quality to the Builders Hardware Manufacturers Association (BHMA) standards stipulated in this specification section and must also meet the approval of the Contracting Officer.

2.5.2 Class/Description

Class/Description	Listed MFGR	Approved Substitutes
HANGING DEVICES		
Hinges ANSI	Bommer	McKinney A8112
BB5000 4.5 x 4.5	TB2714 4.5 x 4.5	
A5112	BB5005 4.5 x 4.5 NRP	T4B3386 4.5 x 4.5 NRP
SECURING DEVICES		
Latch ANSI	DORMA	Schlage
F01	ML9010 x LRA	L9010 x 06
F02	ML9040 x LRA	L9040 x 06
F75	CL810 x LRC	D10 x 06
F76	CL840 x LRC	D40 x 06
Lock ANSI	DORMA	Schlage
F04	ML9050 x LRA	L9050 x 06
F07	ML9080 x LRA	L9080 x 06
F05	ML9070 x LRA	L9070 x 06
Exit Devices ANSI	DORMA	Sargent
Type 1, 09	9300 x YR09	8804 x ETL
Type 1, 23	9300 x YR23	8815 x ETL
CLOSING DEVICES		
Closers ANSI	DORMA	LCN
C02011 PT4,A,B,C,D,H,J	8916	4040
C02011 PT4,A,B,C,D,G,H,J	8916 DS8	4040 CUSH
C02011 PT4,A,B,C,D,G,H,J	8916 DST8	4040 H CUSH
PROTECTIVE PLATES		
Kick Plates ANSI	Rockwood	Trimco
J102	As specified	As specified
STOPS/HOLDERS		
Stops ANSI	Rockwood	Trimco
L02251	409	W1274CCS
ACCESSORIES		
Door Bottom ANSI	Nat'l Guard	Ultra Ind.
R0Y534	601A	WS261

	J32130	225N	DB036
Rain Drip	ANSI N/A	Nat'l Guard 16D	Ultra Ind. WS025
Threshold	ANSI J32130	Nat'l Guard 425E	Ultra Ind. TH015
Weatherstrip	ANSI R3E164	Nat'l Guard 160 Jambs x Head	Ultra Ind. WS003 Jambs x Head
MISCELLANEOUS			
Door Guards	ANSI L13042	Rockwood 604	Ives 498
Silencers	ANSI L03011	Rockwood 608	Ives 20
Viewers	ANSI L03221	Rockwood 622	Ives U698

2.5.3 Finishes

Unless noted otherwise in the Hardware Set the finishes of items of Hardware shall be as follows:

Hinges	626/652
Exit Devices	630
Latch/Lock	626
Closer	689
Protective Plates	630
Stops	626
Door Bottom	628
Threshold	628
Weatherstrip	628
Silencers	Gray

2.6 KEY CABINET AND CONTROL SYSTEM

BHMA A156.5, Type E8341 (125 hooks). Type required to yield a capacity (number of hooks) 50 percent greater than the number of key changes used for door locks.

PART 3 EXECUTION

3.1 INSTALLATION

Install hardware in accordance with manufacturers' printed instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

3.1.1 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws in expansion sleeves.

3.2 FIRE DOORS

Install hardware in accordance with NFPA 80 for fire doors, NFPA 101 for exit doors.

3.3 KEY CABINET AND CONTROL SYSTEM

Locate where directed. Tag one set of file keys and one set of duplicate keys. Place other keys in appropriately marked envelopes, or tag each key. Furnish complete instructions for setup and use of key control system. On tags and envelopes, indicate door and room numbers or master or grand master key.

3.4 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, as directed, errors in cutting and fitting and damage to adjoining work.

3.5 HARDWARE SCHEDULE

Provide finish hardware for each door to comply with requirements of this section, hardware set numbers indicated in door schedule and the following schedule of hardware sets.

HARDWARE SET 1 WDxHMF

Door # (107,207)

Door Sizes

2100 x 910 x 40

EA Door to Receive:

3 Hinges	A8112
1 Exit Device	Type 1, 23
1 Closer	C02011 PT4,A,B,C,D,H,J
1 Kick Plate	J102
1 Wall Stop	L02251
3 Silencers	L03011

HARDWARE SET 2 HMxHMF

Door # (117A,119,120)

Door Sizes

2100 x 910 x 40

EA Door to Receive:

3 Hinges	A8112
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1 Exit Device	Type 1, 23
1 Closer	C02021 PT4,A,B,C,D,G,H,J
1 Kick Plate	J102
1 Wall Stop	L02251
3 Silencers	L03011

HARDWARE SET 3 WDxHMF

Door # (115,215,307,307A,315)

Door Sizes

2100 x 610 x 40

2100 x 910 x 40

EA Door to Receive:

3 Hinges	A8112
1 Lock	F05
1 Wall Stop	L02251
1 Door Bottom	R3E344
1 Weatherstrip	R3E164
3 Silencers	L03011

HARDWARE SET 4 WDxHMF

Door # (107A,114,118,207A,213A,214,313A,314)

Door Sizes

2100 x 610 x 40

2100 x 910 x 40

EA Door to Receive:

3 Hinges	A8112
1 Lock	F07
1 Wall Stop	L02251
3 Silencers	L03011

HARDWARE SET 5 WDxHMF

Door # (113,113A,213,313)

Door Sizes

2100 x 610 x 40

2100 x 910 x 40

EA Door to Receive:

3 Hinges	A8112
1 Latch	F01
1 Wall Stop	L02251
3 Silencers	L03011

HARDWARE SET 6 WDxHMF

Door # (J004,J007,J008,J011,S002,S009)

Door Sizes

2100 x 610 x 40

EA Door to Receive:

3 Hinges	A8112
1 Latch	F75
1 Wall Stop	L02251
3 Silencers	L03011

HARDWARE SET 7 WDxHMF

Door # (109,209,309)

Door Sizes

2100 x 910 x 40

EA Door to Receive:

3 Hinges	A8112
1 Latch	F01
1 Closer	C02011 PT4,A,B,C,D,H,J
1 Wall Stop	L02251
3 Silencers	L03011

HARDWARE SET 8 WDxHMF

Door#(J002,J003,J005,J006,J009,J010,J012,J013,S003,S004,S005,S006,S007,S008)

Door Sizes

2100 x 760 x 40

2100 x 810 x 40

2100 x 910 x 40

EA Door to Receive:

3 Hinges	A8133
1 Latch	F76
1 Wall Stop	L02251
3 Silencers	L03011

HARDWARE SET 9 WDxHMF

Door # (116)

Door Sizes

2100 x 910 x 40

EA Door to Receive:

3 Hinges	A8133
1 Latch	F02
1 Wall Stop	L02251
3 Silencers	L03011

HARDWARE SET 10 HMxHMF

Door # (117,119A,120A)

Door Sizes

2100 x 910 x 40

EA Door to Receive:

3 Hinges	A5112
1 Exit Device	Type 1, 09
1 Closer	C02021 PT4,A,B,C,D,G,H,J
1 Kick Plate	J102
1 Door Bottom	601A
1 Rain Drip	16D

Compatibility with Hellsberg Dorrar door type WI-BD-60 (Same Type A-KARM)
is currently pending Thule AB interface.

HARDWARE SET 11 HMxHMF

Door # (112)

Door Sizes

(2)2100 x 760 x 40

EA Pair to Receive:

6 Hinges	A5112
2 Flush Bolts	14251
1 Dust Proof Strike	L14012
1 Lock	F07

2 Closers	C02061 PT4,A,B,C,D,G,H,J
1 Threshold	J32130
1 Weatherstrip	R3E164

HARDWARE SET 12 WDxHMF

Door # (J001,S001)

Door Sizes

2100 x 910 x 40

EA Door to Receive:

3 Hinges A8112

Key Card Lockset - Generation E-760 Stand-alone card reader with mechanical override option. 626 satin chrome finish. www.kaba-ilco.com

1 Closer	C02011 PT4,A,B,C,D,H,J
1 Wall Stop	L02251
1 Weatherstrip	R3E164
1 Coat Hook	RM801
1 Viewer	L03221
1 Door Guard	L13042

HARDWARE SET 13 WDxHMF

Door # (108,110,208,210,308,310)

Door Sizes

(2)2100 x 760 x 40

EA Pair to Receive:

6 Hinges	A5112
2 Flush Bolts	14251
1 Dust Proof Strike	L14012
1 Lock	F07
2 Closers	C02061 PT4,A,B,C,D,G,H,J
2 Wall Stops	L02251
2 Silencers	L03011

-- End of Section --

SECTION 08800

GLAZING
10/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1984; R 1994) Safety Glazing Materials
Used in Buildings

ASTM INTERNATIONAL (ASTM)

ASTM C 1036 (2001) Flat Glass

ASTM C 1048 (1997b) Heat-Treated Flat Glass - Kind HS,
Kind FT Coated and Uncoated Glass

ASTM C 1172 (2003) Laminated Architectural Flat Glass

ASTM C 509 (2000) Elastomeric Cellular Preformed
Gasket and Sealing Material

ASTM C 864 (1999) Dense Elastomeric Compression Seal
Gaskets, Setting Blocks, and Spacers

ASTM C 920 (2002) Elastomeric Joint Sealants

ASTM E 119 (2000a) Fire Tests of Building
Construction and Materials

ASTM E 1300 (2003) Determining Load Resistance of
Glass in Buildings

ASTM E 2010 (2001) Positive Pressure Fire Tests of
Window Assemblies

ASTM E 773 (2001) Accelerated Weathering of Sealed
Insulating Glass Units

ASTM E 774 (1997) Classification of the Durability of
Sealed Insulating Glass Units

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual (2004) Glazing Manual

GANA Sealant Manual (1990) Sealant Manual

INSULATING GLASS MANUFACTURERS ALLIANCE (IGMA)

SIGMA A1202 (1983) Commercial Insulating Glass
Dimensional Tolerances

SIGMA TB-3001 (1990) Guidelines for Sloped Glazing

SIGMA TM-3000 (1997) Glazing Guidelines for Sealed
Insulating Glass Units

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 252 (2003) Fire Tests of Door Assemblies

NFPA 257 (2000) Fire Test for Window and Glass
Block Assemblies

NFPA 80 (1999) Fire Doors and Fire Windows

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201 Safety Standard for Architectural Glazing
Materials

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Manufacturer's Instructions

Setting and sealing materials

Glass setting

Submit glass manufacturer's recommendations for setting and sealing materials and for installation of each type of glazing material specified. Include cleaning instructions for plastic sheets.

1.3 SYSTEM DESCRIPTION

Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work. Glazed panels shall comply with the safety standards, as indicated in accordance with ANSI Z97.1. Glazed panels shall comply with indicated wind/snow loading in accordance with ASTM E 1300.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in safe, enclosed dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not start glazing work until the outdoor temperature is above 4 degrees C and rising, unless procedures recommended by the glass manufacturer and approved by the Contracting Officer are made to warm the glass and rabbet surfaces. Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp or rainy weather.

1.6 WARRANTY

1.6.1 Warranty for Insulating Glass Units

Warranty insulating glass units against development of material obstruction to vision (such as dust, fogging, or film formation on the inner glass surfaces) caused by failure of the hermetic seal, other than through glass breakage, for a 5-year period following acceptance of the work. Provide new units for any units failing to comply with terms of this warranty within 45 working days after receipt of notice from the Government.

PART 2 PRODUCTS

2.1 GLASS

ASTM C 1036, unless specified otherwise. In doors and sidelights, provide safety glazing material conforming to 16 CFR 1201.

2.1.1 Clear Glass

For interior glazing (i.e., pass and observation windows), 6 mm thick glass should be used.

Type I, Class 1 (clear), Quality q4 (A). Provide for glazing openings not indicated or specified otherwise. Use double-strength sheet glass or 3 mm float glass for openings up to and including 1.39 square meters, 4.5 mm for glazing openings over 1.39 square meters but not over 2.79 square meters, and 6 mm for glazing openings over 2.79 square meters but not over 4.18 square meters.

2.1.2 Wired Glass

Glass for fire-rated windows shall be UL listed and shall be rated for 20 minutes when tested in accordance with ASTM E 2010. Wired glass shall be Type II flat type, Class q8 - glazing, Form 1 - wired and polished both sides, conforming to ASTM C 1036. Wire mesh shall be polished stainless steel Mesh 2 - square. Wired glass for fire-rated windows shall bear an

identifying UL label or the label of a nationally recognized testing agency, and shall be rated for 20 minutes when tested in accordance with NFPA 257. Wired glass for fire-rated doors shall be tested as part of a door assembly in accordance with NFPA 252.

2.1.3 Laminated Glass

Fabricated from two pieces of Type I, Class 1, Quality q3 glass laminated together with a clear 0.38 mm thick polyvinyl butyral interlayer or alternatives such as resin laminates, conforming to requirements of 16 CFR 1201 and ASTM C 1172. Color shall be clear. The total thickness shall be nominally 4 mm.

2.1.4 Mirrors

2.1.4.1 Glass Mirrors

Glass for mirrors shall be Type I transparent flat type, Class 1-clear, Glazing Quality q1 6 mm (1/4 inch) thick conforming to ASTM C 1036. Glass color shall be clear. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 6 mm (1/4 inch) thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint, and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.1.5 Fire/Safety Rated Glass

Fire/safety rated glass shall be laminated Type I transparent flat type, Class 1-clear. Glass shall have a 20 minute rating when tested in accordance with ASTM E 119. Glass shall be permanently labeled with appropriate markings.

2.2 INSULATING GLASS UNITS

Two panes of glass separated by a dehydrated airspace and hermetically sealed. Dimensional tolerances shall be as specified in SIGMA A1202. The units shall conform to ASTM E 773 and ASTM E 774, Class A. Spacer shall be roll-formed, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

2.2.1 Buildings

Provide 13 mm airspace. The inner light shall be ASTM C 1036, Type I, Class 1, Quality q4, 3 mm thick. The outer light shall be ASTM C 1036,

Type I, Class 1 (transparent), Quality q4, 3 mm thick ASTM C 1048, Grade B (fully tempered), Style I (uncoated).

2.3 SETTING AND SEALING MATERIALS

2.3.1 Sealants

2.3.1.1 Elastomeric Sealant

ASTM C 920, Type S or M, Grade NS, Class 12.5, Use G. Use for channel or stop glazing metal sash. Sealant shall be chemically compatible with setting blocks, edge blocks, and sealing tapes. Color of sealant shall be white.

2.3.2 Glazing Gaskets

Glazing gaskets shall be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Glazing gasket profiles shall be as indicated on drawings.

2.3.2.1 Fixed Glazing Gaskets

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM C 509, Type 2, Option 1.

2.3.2.2 Wedge Glazing Gaskets

Wedge glazing gaskets shall be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to ASTM C 864, Option 1, Shore A durometer between 65 and 75.

2.3.2.3 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing shall be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight.

2.3.3 Accessories

Provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide noncorroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers.

2.4 MIRROR ACCESSORIES

2.4.1 Mastic

Mastic for setting mirrors shall be a polymer type mirror mastic resistant

to water, shock, cracking, vibration and thermal expansion. Mastic shall be compatible with mirror backing paint, and shall be approved by mirror manufacturer.

2.4.2 Mirror Frames

Mirrors shall be provided with mirror frames (J-mold channels) fabricated of one-piece roll-formed Type 304 stainless steel with No. 4 brushed satin finish and concealed fasteners which will keep mirrors snug to wall. Frames shall be 32 x 6 x 6 mm (1-1/4 x 1/4 x 1/4 inch) continuous at top and bottom of mirrors. Concealed fasteners of type to suit wall construction material shall be provided with mirror frames.

2.4.3 Mirror Clips

Concealed fasteners of type to suit wall construction material shall be provided with clips.

PART 3 EXECUTION

3.1 PREPARATION

Preparation, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, SIGMA TB-3001, SIGMA TM-3000, and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work. Leave labels in place until the installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

3.2 GLASS SETTING

Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, SIGMA TB-3001, SIGMA TM-3000, and manufacturer's recommendations. Aluminum windows, wood doors, and wood windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place.

3.2.1 Sheet Glass

Cut and set with the visible lines or waves horizontal.

3.2.2 Insulating Glass Units

Do not grind, nip, or cut edges or corners of units after the units have

left the factory. Springing, forcing, or twisting of units during setting will not be permitted. Handle units so as not to strike frames or other objects. Installation shall conform to applicable recommendations of SIGMA TB-3001 and SIGMA TM-3000.

3.2.3 Installation of Wire Glass

Install glass for fire doors in accordance with installation requirements of NFPA 80.

3.2.4 Installation of Laminated Glass

Sashes which are to receive laminated glass shall be weeped to the outside to allow water drainage into the channel.

3.3 CLEANING

Clean glass surfaces and remove labels, paint spots, putty, and other defacement as required to prevent staining. Glass shall be clean at the time the work is accepted. Clean plastic sheet in accordance with manufacturer's instructions.

3.4 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

3.5 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements are as follows:

<u>PRODUCTS</u>	<u>INCH-POUND</u>	<u>METRIC</u>
Glass	1/8 inch	3 mm
	3/16 inch	4.5 mm
	7/32 inch	6 mm
	1/4 inch	6 mm
	3/8 inch	10 mm
Interlayer	0.015 inch	0.38 mm
Glazing Channels	1/4 inch	6 mm

-- End of Section --

SECTION 09100

METAL SUPPORT ASSEMBLIES

08/04

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 463/A 463M	(2002a) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C 645	(2003) Nonstructural Steel Framing Members
ASTM C 754	(2000) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
ASTM C 841	(2003) Installation of Interior Lathing and Furring

METAL LATH/STEEL FRAMING ASSOCIATION (ML/SFA)

NAAMM ML/SFA MLF	(1991) Metal Lathing and Furring
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UNDERWRITERS LABORATORIES (UL)

UL Fire Resist Dir	(2004) Fire Resistance Directory
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Metal support systems; G

Submit for the erection of metal ceiling suspension systems. Indicate materials, sizes, thicknesses, and fastenings.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the job site and store in ventilated dry locations. Storage area shall permit easy access for inspection and handling. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather. Handle materials carefully to prevent damage. Remove damaged items and provide new items.

PART 2 PRODUCTS

2.1 MATERIALS

Provide steel materials for metal support systems with galvanized coating ASTM A 653/A 653M, Z180; aluminum coating ASTM A 463/A 463M, T1-75 ; or a 55-percent aluminum-zinc coating.

2.1.1 Materials for Attachment of Lath

2.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C 841. Steel structure above Operation room and X-Ray room in accordance with structural design and constructions.

2.1.2 Materials for Attachment of Gypsum Wallboard

Are to be in steel. Note specifications from Danogips or other manufacturer.

2.1.2.1 Suspended and Furred Ceiling Systems

ASTM C 645. In accordance to manufacturer specifications.

2.1.2.2 Nonload-Bearing Wall Framing and Furring

In accordance to manufacturer specifications.

2.1.2.3 Furring Structural Steel Columns

ASTM C 645. Steel (furring) clips and support angles listed in UL Fire Resist Dir may be provided in lieu of steel studs for erection of gypsum wallboard around structural steel columns.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Systems for Attachment of Lath

3.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C 841, except as indicated otherwise.

3.1.1.2 Nonload-Bearing Wall Framing

NAAMM ML/SFA MLF, except that framing members shall be 400 mm o.c. unless indicated otherwise.

3.1.2 Systems for Attachment of Gypsum Wallboard

3.1.2.1 Suspended and Furred Ceiling Systems

ASTM C 754, except that framing members shall be 400 mm o.c. unless indicated otherwise.

3.1.2.2 Nonload-Bearing Wall Framing and Furring

ASTM C 754, except as indicated otherwise.

3.2 ERECTION TOLERANCES

Framing members which will be covered by finish materials such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:

- a. Layout of walls and partitions: 6 mm from intended position;
- b. Plates and runners: 5 mm in 1.9 meters from a straight line;
- c. Studs: 5 mm in 1.9 meters out of plumb, not cumulative; and
- d. Face of framing members: 5 mm in 1.9 meters from a true plane.

Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive shall be within the following limits:

- a. Layout of walls and partitions: 6 mm from intended position;
- b. Plates and runners: 5 mm in 3.8 meters from a straight line;
- c. Studs: 5 mm in 3.8 meters out of plumb, not cumulative; and
- d. Face of framing members: 5 mm in 3.8 meters from a true plane.

-- End of Section --

SECTION 09250

GYPSUM BOARD
11/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.11 (1992) Interior Installation of
Cementitious Backer Units

ASTM INTERNATIONAL (ASTM)

ASTM C 1002 (2001) Steel Self-Piercing Tapping Screws
for the Application of Gypsum Panel
Products or Metal Plaster Bases to Wood
Studs or Steel Studs

ASTM C 1047 (1999) Accessories for Gypsum Wallboard
and Gypsum Veneer Base

ASTM C 1396/C 1396M (2003) Gypsum Board

ASTM C 36/C 36M (2001) Gypsum Wallboard

ASTM C 442/C 442M (2001) Gypsum Backing Board, Gypsum
Coreboard, and Gypsum Shaftliner Board

ASTM C 630/C 630M (2001) Water-Resistant Gypsum Backing Board

ASTM C 840 (2003) Application and Finishing of Gypsum
Board

ASTM C 954 (2000) Steel Drill Screws for the
Application of Gypsum Panel Products or
Metal Plaster Bases to Steel Studs from
0.033 in. (0.84 mm) to 0.112 in. (2.84 mm)
in Thickness

ASTM D 226 (1997a) Asphalt-Saturated Organic Felt
Used in Roofing and Waterproofing

GYPSUM ASSOCIATION (GA)

GA 214 (1996) Recommended Levels of Gypsum Board

Finish

GA 216 (2000) Application and Finishing of Gypsum Board

GA 600 (2003) Fire Resistance Design Manual

UNDERWRITERS LABORATORIES (UL)

UL Fire Resist Dir (2003) Fire Resistance Directory (Vol 1, 2A, 2B & 3)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Cementitious backer units

Glass Mat Water-Resistant Gypsum Tile Backing Board

Water-Resistant Gypsum Backing Board

Glass Mat Covered or Reinforced Gypsum Sheathing

Glass Mat Covered or Reinforced Gypsum Sheathing Sealant

Impact Resistant Gypsum Board

Accessories

Submit for each type of gypsum board and for cementitious backer units.

SD-07 Certificates

Asbestos Free Materials; G

Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

Deliver materials in the original packages, containers, or bundles with

each bearing the brand name, applicable standard designation, and name of manufacturer, or supplier.

1.3.2 Storage

Keep materials dry by storing inside a sheltered building. Where necessary to store gypsum board and cementitious backer units outside, store off the ground, properly supported on a level platform, and protected from direct exposure to rain, snow, sunlight, and other extreme weather conditions. Provide adequate ventilation to prevent condensation.

1.3.3 Handling

Neatly stack gypsum board and cementitious backer units flat to prevent sagging or damage to the edges, ends, and surfaces.

1.4 ENVIRONMENTAL CONDITIONS

1.4.1 Temperature

Maintain a uniform temperature of not less than 10 degrees C in the structure for at least 48 hours prior to, during, and following the application of gypsum board, cementitious backer units, and joint treatment materials, or the bonding of adhesives.

1.4.2 Exposure to Weather

Protect gypsum board and cementitious backer unit products from direct exposure to rain, snow, sunlight, and other extreme weather conditions.

1.5 QUALIFICATIONS

Manufacturer shall specialize in manufacturing the types of material specified and shall have a minimum of 5 years of documented successful experience. Installer shall specialize in the type of gypsum board work required and shall have a minimum of 3 years of documented successful experience.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to specifications, standards and requirements specified herein. Provide gypsum board types, gypsum backing board types, cementitious backing units, and joint treating materials manufactured from asbestos free materials only.

2.1.1 Gypsum Board

ASTM C 36/C 36M and ASTM C 1396/C 1396M. Wall types and wall construction is to be as shown on construction document drawings. Wall types and products shall be as Danogips wall-construction systems.

2.1.1.1 Regular 13 mm gypsum board as type Dano A1

900 mm wide, 12.5 mm thick, tapered and featured edges. Used for wall and ceiling.

2.1.1.2 Foil-Backed 13 mm

900 mm wide, 12.5 mm thick, tapered and featured edges.

2.1.1.3 Special Fire-Resistant 15 mm F1

900 mm wide, 15.0 mm thick, tapered edges.

2.1.2 Regular Board Types

Gypsum board for wet rooms: Water-resistant Gypsum Board Type H1 from Danogips. Dimension 900 mm wide, 12.5 mm hall be used in wet rooms in double-sheet, including vapor against moisture.

2.1.2.1 Regular Board for Shower Areas

Regular type Aquapanel from Danogips is to be used in shower area dim 900/600 mm, mounted on H1 gypsum board from Danogips on wall and ceiling. Aquapanel is to be used in shower areas in the wet rooms and body-hold room.

2.1.2.2 Gypsum Board for Floor Treatment

Includes Sequence of Composite Floor system Installation including Insulation and Metal Decking.

- a. 150 mm floor deck- Refer to structural drawings and specifications.
- b. 30 mm sub floor deck, corrugation perpendicular to that of the 150 mm floor deck. Refer to structural drawings and specifications.
- c. 12.5 mm gypsum board, floating- Danogips S/E.
- d. 50 mm hard Rock Wool bats, floating.
- e. 12.5 mm gypsum board, floating- Danogips S/E.
- f. 13 mm fiber reinforced gypsum board, perpendicular to the first layer, floating-Danogips GP3.
- g. 19 mm gypsum floor planks, perpendicular and glued to the underlying layer- Danogips GF- utilizing Danogips Gulvlim- special glue for Danogips floor element type A3+GP. Both surfaces to be bonded are to be clean and dry and well adjusted. Apply the glue in an even layer with trowel, brush or roller. Glue to be applied to both surfaces to obtain adequate adhesion. Join the materials to pressure after max. 10 minutes. After gluing, do not apply loads to floor area for a minimum of 2-hours.
- h. Finish floor covering adhered to gypsum board substrate in accordance with sections 09650 and 09680.

2.1.2.3 Regular Gypsum Board Type A1

900 mm wide, 12.7 mm thick, tapered edges.

2.1.3 Joint Treatment Materials

Joints/fillings in wetroom areas are to be as Sikasil S in color grey and white. Joints/fillings between gypsum boards are to be as Sikasil N. Please note details on drawings.

2.1.3.1 Embedding Compound

Specifically formulated and manufactured for use in embedding tape at gypsum board joints and compatible with tape, substrate and fasteners. As Danogips finish.

2.1.3.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound. As Danogips finish.

2.1.3.3 Joint Tape

Cross-laminated, tapered edge, reinforced paper, or tape recommended by the manufacturer.

2.1.4 Fasteners

2.1.4.1 Screws

ASTM C 1002, Type "G", Type "S" or Type "W" steel drill screws for fastening gypsum board to gypsum board, and steel framing members less than 0.84 mm thick. ASTM C 954 steel drill screws for fastening gypsum board to steel framing members 0.84 to 2.84 mm thick. Provide cementitious backer unit screws with a polymer coating.

2.1.5 Adhesives

Do not use adhesive containing benzene, carbon tetrachloride, or trichloroethylene.

2.1.5.1 Adhesive for Fastening Gypsum Board to Metal Framing

Type recommended by gypsum board manufacturer.

2.1.5.2 Adhesive for Laminating

For laminating two-ply gypsum board systems, provide adhesive recommended by gypsum board manufacturer.

2.1.6 Gypsum Studs

25 mm minimum thickness and 150 mm minimum width. Studs may be of 25 mm thick gypsum board or multilayers laminated to required thickness. Conform to ASTM C 36/C 36M or ASTM C 442/C 442M for material.

2.1.7 Accessories

ASTM C 1047. Fabricate from corrosion protected steel or plastic designed for intended use. Accessories manufactured with paper flanges are not acceptable. Flanges shall be free of dirt, grease, and other materials that may adversely affect bond of joint treatment. Provide prefinished or job decorated materials.

2.1.8 Asphalt Impregnated Building Felt

The moisture barrier over gypsum sheathing shall be 6.7 kg asphalt impregnated felt conforming to ASTM D 226 Type I (No. 15).

2.1.9 Water

Clean, fresh, and potable.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Framing and Furring

Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board and cementitious backer units. Verify that all blocking, headers and supports are in place to support plumbing fixtures and to receive soap dishes, grab bars, towel racks, and similar items. Do not proceed with work until framing and furring are acceptable for application of gypsum board and cementitious backer units.

3.1.2 Gypsum Board and Framing

Verify that surfaces of gypsum board and framing to be bonded with an adhesive are free of dust, dirt, grease, and any other foreign matter. Do not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

3.2 APPLICATION OF GYPSUM BOARD

Apply gypsum board to framing and furring members in accordance with ASTM C 840 or GA 216 and the requirements specified herein. Apply gypsum board with separate panels in moderate contact; do not force in place. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length. Cut out gypsum board as required to make neat close joints around openings. In vertical application of gypsum board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece. Surfaces of gypsum board and substrate members may be bonded together with an adhesive, except where prohibited by fire rating(s). Treat edges of cutouts for plumbing pipes, screwheads, and joints with water-resistant compound as recommended by the gypsum board manufacturer. Provide type of gypsum board for use in each system specified herein as indicated.

3.2.1 Semi-Solid Gypsum Board Partitions

Provide in accordance with ASTM C 840, System IV or GA 216 .

3.2.2 Solid Gypsum Board Partitions

Provide in accordance with ASTM C 840, System V or GA 216.

3.2.3 Application of Gypsum Board to Steel Framing and Furring

Apply in accordance with ASTM C 840, System VIII or GA 216.

3.2.4 Arches and Bending Radii

Apply gypsum board in accordance with ASTM C 840, System IX or GA 216.

3.2.5 Gypsum Board for Wall Tile or Tile Base Applied with Adhesive

In dry areas (areas other than tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply glass matt water-resistant gypsum tile backing board or water-resistant gypsum backing board in accordance with ASTM C 840, System X or GA 216.

3.2.6 Gypsum Board Composite Floor System

- a. 12.5 mm gypsum board, floating- Danogips S/E over composite metal decking.
- b. 50 mm hard Rock Wool bats, floating.
- c. 12.5 mm gypsum board, floating- Danogips S/E.
- d. 13 mm fiber reinforced gypsum board, perpendicular to the first layer, floating-Danogips GP3.
- e. 19 mm gypsum floor planks, perpendicular and glued to the underlying layer- Danogips GF- utilizing Danogips Gulvlim- special glue for Danogips floor element type A3+GP. Both surfaces to be bonded are to be clean and dry and well adjusted. Apply the glue in an even layer with trowel, brush or roller. Glue to be applied to both surfaces to obtain adequate adhesion. Join the materials to pressure after max. 10 minutes. After gluing, do not apply loads to floor area for a minimum of 2-hours.
- f. Finish floor covering adhered to gypsum board substrate in accordance with sections 09650 and 09680.

Note: Refer to isometric detail 4 of sheet A-515 for composite floor assembly diagram.

3.2.7 Floating Interior Angles

Locate the attachment fasteners adjacent to ceiling and wall intersections in accordance with ASTM C 840, System XII or GA 216, for two-ply applications of gypsum board to wood framing.

3.2.8 Application of Foil-Backed Gypsum Board

Apply foil-backed gypsum board in accordance with ASTM C 840, System XIV or

GA 216.

3.3 APPLICATION OF CEMENTITIOUS BACKER UNITS

3.3.1 Application

In wet areas (tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply cementitious backer units in accordance with ANSI A108.11. A 7.6 kg asphalt impregnated, continuous felt paper membrane shall be placed behind cementitious backer units, between backer units and studs or base layer of gypsum board. Membrane shall be placed with a minimum 150 mm overlap of sheets laid shingle style.

3.3.2 Joint Treatment

ANSI A108.11.

3.4 FINISHING OF GYPSUM BOARD

Tape and finish gypsum board in accordance with ASTM C 840, GA 214 and GA 216. Plenum areas above ceilings shall be finished to Level 1 in accordance with GA 214. Water resistant gypsum backing board, ASTM C 630/C 630M, to receive ceramic tile shall be finished to Level 2 in accordance with GA 214. Walls and ceilings to receive a heavy-grade wall covering or heave textured finish before painting shall be finished to Level 3 in accordance with GA 214. Walls and ceilings without critical lighting to receive flat paints, light textures, or wall coverings shall be finished to Level 4 in accordance with GA 214. Unless otherwise specified, all gypsum board walls, partitions and ceilings shall be finished to Level 5 in accordance with GA 214. Provide joint, fastener depression, and corner treatment. Do not use fiber glass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer.

3.4.1 Uniform Surface

Wherever gypsum board is to receive eggshell, semigloss or gloss paint finish, or where severe, up or down lighting conditions occur, finish gypsum wall surface in accordance to GA 214 Level 5. In accordance with GA 214 Level 5, apply a thin skim coat of joint compound to the entire gypsum board surface, after the two-coat joint and fastener treatment is complete and dry.

3.5 SEALING

Seal openings around pipes, fixtures, and other items projecting through gypsum board and cementitious backer units as specified in Section 07920 JOINT SEALANTS. Apply material with exposed surface flush with gypsum board. Color in accordance with Section 09900.

3.5.1 Sealing for Glass Mat or Reinforced Gypsum Board Sheathing

Apply silicone sealant in a 9.5 mm bead to all joints and trowel flat.

Apply enough of the same sealant to all fasteners penetrating through the glass mat gypsum board surface to completely cover the penetration when troweled flat.

3.6 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated construction is indicated, provide materials and application methods, including types and spacing of fasteners, wall and ceiling in accordance with the specifications contained in UL Fire Resist Dir for the Design Number(s) indicated, or GA 600 for the File Number(s) indicated. Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL test requirements or GA requirements. Penetrations through rated partitions and ceilings shall be sealed tight in accordance with tested systems. Fire ratings shall be as indicated.

-- End of Section --

SECTION 09310

CERAMIC TILE, QUARRY TILE, AND PAVER TILE
8/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.1	(1999) Installation of Ceramic Tile; including A108.1A-C, 108.4-.13, 118.1-.10, A136.1
ANSI A108.1A	(1992) Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar
ANSI A108.1B	(1992) Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar
ANSI A108.4	(1992) Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar
ANSI A108.8	(1992) Installation of Ceramic Tile with Chemical Resistant Furan Mortar and Grout
ANSI A118.2	(1992) Conductive Dry-Set Portland Cement Mortar
ANSI A118.3	(1992) Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive
ANSI A118.4	(1992) Latex-Portland Cement Mortar
ANSI A118.5	(1992) Chemical Resistant Furan Mortars and Grouts for Tile
ANSI A118.6	(1992) Ceramic Tile Grouts
ANSI A118.9	(1992) Test Methods and Specifications for Cementitious Backer Units

ANSI A136.1 (1992) Organic Adhesives for Installation
of Ceramic Tile

ANSI A137.1 (1988) Ceramic Tile

ASTM INTERNATIONAL (ASTM)

ASTM C 1026 (1987; R 2002) Measuring the Resistance of
Ceramic Tile to Freeze-Thaw Cycling

ASTM C 1027 (1999) Determining Visible Abrasion
Resistance of Glazed Ceramic Tile

ASTM C 1028 (1996) Determining the Static Coefficient
of Friction of Ceramic Tile and Other Like
Surfaces by the Horizontal Dynamometer
Pull-Meter Method

ASTM C 373 (1988; R 1999) Water Absorption, Bulk
Density, Apparent Porosity, and Apparent
Specific Gravity of Fired Whiteware
Products

ASTM C 648 (1998) Breaking Strength of Ceramic Tile

TILE COUNCIL OF AMERICA (TCA)

TCA Hdbk (2003-2004) Handbook for Ceramic Tile
Installation

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Tile
Setting-Bed
Mortar, Grout, and Adhesive

Manufacturer's catalog data and preprinted installation and
cleaning instructions.

SD-04 Samples

Tile
Accessories
Marble Thresholds

Samples of sufficient size to show color range, pattern, type and joints.

SD-06 Test Reports

Testing

Copy of results for electrical resistance tests.

SD-07 Certificates

Tile

Mortar, Grout, and Adhesive

Certificates indicating conformance with specified requirements. A master grade certificate shall be furnished for tile.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover in accordance with manufacturer's instructions.

1.4 ENVIRONMENTAL REQUIREMENTS

Ceramic tile work shall not be performed unless the substrate and ambient temperature is at least 10 degrees C and rising. Temperature shall be maintained above 10 degrees C while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used they shall be vented to the outside to avoid carbon dioxide damage to new tilework.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided.

1.6 EXTRA STOCK

Supply an extra two percent of each type tile used in clean and marked cartons.

PART 2 PRODUCTS

2.1 TILE

Tile shall be standard grade conforming to ANSI A137.1. Containers shall be grade sealed. Seals shall be marked to correspond with the marks on the signed master grade certificate. Tile shall be impact resistant with a minimum breaking strength for wall tile of 41 kg and 113 kg for floor tile in accordance with ASTM C 648. Tile for cold climate projects shall be rated frost resistant by the manufacturer as determined by ASTM C 1026.

Water absorption shall be maximum percent by weight by 0.5 in accordance with ASTM C 373. Floor tile shall have a minimum coefficient of friction of 0.60 wet and dry in accordance with ASTM C 1028. Floor tile shall be Class III-Medium Heavy Traffic, durability classification as rated by the manufacturer when tested in accordance with ASTM C 1027 for abrasion resistance as related to foot traffic. Color shall be in accordance with Section 09915 COLOR SCHEDULE.

2.1.1 PAVER TILE

Paver tile shall be glazed, size: refer to CID submission. Color shall be in accordance with Section 09915 COLOR SCHEDULE.

2.1.2 Glazed Wall Tile

Glazed wall tile and trim shall be cushion edged glaze. Color shall be in accordance with Section 09915 COLOR SCHEDULE.

2.2 SETTING-BED

The setting-bed shall be composed of the following:

2.3 WATER

Water shall be potable.

2.4 MORTAR, GROUT, AND ADHESIVE

Mortar, grout, and adhesive shall conform to the following:

2.4.1 Dry-Set Portland Cement Mortar

ANSI A108.1.

2.4.2 Conductive Dry-Set Mortar

ANSI A118.2.

2.4.3 Latex-Portland Cement Mortar

ANSI A118.4.

2.4.4 Ceramic Tile Grout

ANSI A118.6.

2.4.5 Organic Adhesive

ANSI A136.1 Type I is to be used for mounting ceramic tile on floor and walls in bathrooms and wetrooms.

2.4.6 Epoxy Resin Grout

ANSI A118.3.

2.4.7 Furan Resin Grout

ANSI A118.5 and consist of an intimate mixture of furfuryl-alcohol resin with carbon filler and catalyst.

2.4.8 Cementitious Backer Board

Cementitious backer units, for use as tile substrate over wood sub-floors, shall be in accordance with ANSI A118.9. Cementitious backer units shall be 12.7 mm thick.

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

Surface to receive tile shall be inspected and shall conform to the requirements of ANSI A108.1 for surface conditions for the type setting bed specified and for workmanship. Variations of surface to be tiled shall fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	3 mm in 2.4 meters	3.0 mm in 3 meters
Organic Adhesives	3 mm in 2.4 meters	1.5 mm in 1 meters
Latex portland cement mortar	3 mm in 2.4 meters	3.0 mm in 3 meters
Epoxy	3 mm in 2.4 meters	3.0 mm in 3 meters

3.2 GENERAL INSTALLATION REQUIREMENTS

Tile work shall not be started until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Floor tile installation shall not be started in spaces requiring wall tile until after wall tile has been installed. Tile in colors and patterns indicated shall be applied in the area shown on the drawings. Tile shall be installed with the respective surfaces in true even planes to the elevations and grades shown. Special shapes shall be provided as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Tile bases and coves shall be solidly backed with mortar.

3.3 INSTALLATION OF WALL TILE

Wall tile shall be installed in accordance with the TCA Hdbk.

3.3.1 Dry-Set Mortar and Latex-Portland Cement Mortar

Dry-set shall be used to install tile in accordance with ANSI A108.1. Latex portland cement shall be used when installing porcelain ceramic tile.

3.3.2 Organic Adhesive

Organic adhesive installation of ceramic tile shall conform to ANSI A108.4.

3.3.3 Furan Mortar and Grout

Furan mortar and grout installation shall conform to ANSI A108.8.

3.4 INSTALLATION OF FLOOR TILE

Floor tile shall be installed in accordance with TCA Hdbk. Floor tile must be installed and placed in accordance to the architectural plan. Before installing the tile, lay out to check the measurement. Floor tile in shower areas shall slope towards the drain. Slope is to be minimum 30 mm by 1000 mm. Mortar and grout to be of the flexible type.

3.4.1 Workable or Cured Mortar Bed

Floor tile shall be installed over a workable mortar bed or a cured mortar bed at the option of the Contractor. Workable mortar bed materials and installation shall conform to ANSI A108.1A. Cured mortar bed and materials shall conform to ANSI A108.1B.

3.4.2 Ceramic Tile Grout

Ceramic Tile grout shall be prepared and installed in accordance with ANSI A108.1.

3.4.3 Waterproofing

Shower pans are specified in Section 15400A PLUMBING, GENERAL PURPOSE. Waterproofing under concrete fill shall conform to the requirements of Section 07132A BITUMINOUS WATERPROOFING.

3.5 INSTALLATION OF MARBLE THRESHOLDS

Thresholds shall be installed where indicated in a manner similar to that of the ceramic tile floor. Thresholds shall be the full width of the opening. Head joints at ends shall not exceed 6 mm in width and shall be grouted full as specified for ceramic tile.

3.6 EXPANSION JOINTS

Joints shall be formed as indicated and sealed as specified in Section 07920 JOINT SEALANTS.

3.6.1 Walls

Expansion joints shall be provided at control joints in backing material. Wherever backing material changes, an expansion joint shall be installed to separate the different materials.

3.6.2 Floors

Expansion joints shall be provided over construction joints, control joints, and expansion joints in concrete slabs. Expansion joints shall be provided where tile abuts restraining surfaces such as perimeter walls,

curbs and columns and at intervals of 7.2 to 10.8 m each way in large interior floor areas and 3.6 to 4.8 m each way in large exterior areas or areas exposed to direct sunlight or moisture. Expansion joints shall extend through setting-beds and fill.

3.7 CLEANING AND PROTECTING

Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with resinous grout or with factory mixed grout shall be cleaned in accordance with instructions of the grout manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a noncorrosive soap or other approved method of protection. Tiled floor areas shall be covered with building paper before foot traffic is permitted over the finished tile floors. Board walkways shall be laid on tiled floors that are to be continuously used as passageways by workmen. Damaged or defective tiles shall be replaced.

-- End of Section --

SECTION 09510

ACOUSTICAL CEILINGS

07/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 423	(2002a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C 635	(2000) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C 636	(2003) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM C 834	(2000e1) Latex Sealants
ASTM E 1264	(1998) Acoustical Ceiling Products
ASTM E 1477	(1998a; R 2003) Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings

Drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan.

SD-03 Product Data

Acoustical Ceiling Systems

Manufacturer's descriptive data, catalog cuts, and installation instructions. Submittals which do not provide adequate data for the product evaluation will be rejected.

SD-04 Samples

Acoustical Units

Two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color.

SD-07 Certificates

Acoustical Units

Certificate attesting that the mineral based acoustical units furnished for the project contain recycled material and showing an estimated percent of such material.

1.3 GENERAL REQUIREMENTS

Acoustical treatment shall consist of sound controlling units mechanically mounted on a ceiling suspension system. The unit size, texture, finish, and color shall be as specified. The Contractor has the option to substitute inch-pound (I-P) Recessed Light Fixtures (RLF) for metric RLF. If the Contractor opts to furnish I-P RLF, other ceiling elements like acoustical ceiling tiles, air diffusers, air registers and grills, shall also be I-P products. The Contractor shall coordinate the whole ceiling system with other details, like the location of access panels and ceiling penetrations, etc., shown on the drawings. If I-P products are used, the Contractor shall be responsible for all associated labor and materials and for the final assembly and performance of the specified work and products. The location and extent of acoustical treatment shall be as shown on the approved detail drawings. Reclamation of mineral fiber acoustical ceiling panels to be removed from the job site shall be in accordance with paragraph RECLAMATION PROCEDURES.

1.3.1 Ceiling Sound Absorption

Determine the NRC in accordance with ASTM C 423 Method of Test.

1.3.2 Light Reflectance

Determine light reflectance factor in accordance with ASTM E 1477 Test Method.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials

shall be carefully handled and stored in dry, watertight enclosures. Immediately before installation, acoustical units shall be stored for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.5 ENVIRONMENTAL REQUIREMENTS

A uniform temperature of not less than 16 degrees C nor more than 29 degrees C and a relative humidity of not more than 70 percent shall be maintained for 24 hours before, during, and 24 hours after installation of acoustical units.

1.6 SCHEDULING

Interior finish work such as plastering, concrete and terrazzo work shall be complete and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided. Standard performance guarantee or warranty shall contain an agreement to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of grid system.

1.8 EXTRA MATERIALS

Spare tiles of each color shall be furnished at the rate of 5 tiles for each 1000 tiles installed. Tiles shall be from the same lot as those installed.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Acoustical units shall conform to ASTM E 1264, Class A, and the following requirements:

2.1.1 Units for Exposed-Grid System A, Focus System E

Type: IV (non-asbestos mineral fiber with membrane-faced overlay).

Minimum NRC: Focus E, Type 1 NRC = 0.85 in accordance to ASTM C 423.
Hygiene Advance Type 2 NRC = 0.80 in accordance to ASTM C 423

Pattern: Focus E, Type 1 in accordance to Ecophone Sample, Ecophone Hygiene advanced in accordance to sample.

Nominal size: 24 x 24 inches.

Edge detail: Reveal.

Finish: Factory-applied in accordance to sample standard finish, color finish White Ecophon Number 141.

Minimum LR coefficient: 84 percent light reflectance Focus F.

Minimum CAC: 40.

Flame Spread: Class A, 25 or less

2.1.2 Units for Concealed-Grid System as Focus Advantage Hygiene

Type: III (non-asbestos mineral fiber with membrane-faced overlay). Type Ecophone, Hygiene Advantage.

Minimum NRC: 0.8 in accordance to Focus and ASTM C 423.

Pattern: In accordance to sample.

Nominal size: 24 x 24 inches.

Edge detail: beveled.

Joint detail: kerfed and rabbeted.

Finish: Factory-applied standard finish.

Minimum LR coefficient: LR-1, 0.75 or greater.

Minimum CAC: 40.

Flame Spread: Class A, 25 or less.

2.2 SUSPENSION SYSTEM

Suspension system shall be exposed grid for system Hygiene Advance and direct hung for type Focus D concealed upward access standard width flange, and shall conform to ASTM C 635 for intermediate-duty systems. Surfaces exposed to view shall be aluminum or steel with a factory-applied white baked-enamel finish. Suspended ceiling framing system shall have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. The suspension system shall have a maximum deflection of 1/360 of span length.

2.3 HANGERS

Hangers and attachment shall support a minimum 1330 N ultimate vertical load without failure of supporting material or attachment.

2.3.1 Rods

Rods shall be 5 mm diameter threaded steel rods, zinc or cadmium coated.

2.4 ACCESS PANELS

Access panels shall match adjacent acoustical units and shall be designed and equipped with suitable framing and fastenings for removal and replacement without damage. Panel shall be not less than 300 by 300 mm or more than 300 by 600 mm.

- a. An identification plate of 0.8 mm thick aluminum, 19 mm in diameter, stamped with the letters "AP" and finished the same as the unit, shall be attached near one corner on the face of each access panel.
- b. Identify ceiling access panel by a number utilizing white identification plates or plastic buttons with contrasting numerals. The plates or buttons shall be of minimum 25 mm diameter and securely attached to one corner of each access unit. Provide a typewritten card framed under glass listing the code identification numbers and corresponding system descriptions listed above. Mount the framed card where directed and furnish a duplicate card to the Contracting Officer. Code identification system shall be as follows:

- 1 Air conditioning duct system
- 2 Sprinkler system

2.5 ADHESIVE

Adhesive shall be as recommended by tile manufacturer.

2.6 FINISHES

Acoustical units and suspension system members shall have manufacturer's standard textures, patterns and finishes as specified. Ceiling suspension system components shall be treated to inhibit corrosion.

2.7 COLORS AND PATTERNS

Colors and patterns for acoustical units and suspension system components shall be as shown in samples from Ecophon (White) and specified in Section 09915 - Color Schedule.

2.8 ACOUSTICAL SEALANT

Acoustical sealant shall conform to ASTM C 834, nonstaining.

PART 3 EXECUTION

3.1 INSTALLATION

Examine surfaces to receive directly attached acoustical units for

unevenness, irregularities, and dampness that would affect quality and execution of the work. Areas where acoustical units will be cemented shall be free of oils, form residue, or other materials that reduce bonding capabilities of the adhesive. Interior finish work such as plastering, concrete, and terrazzo work shall be completed and dry before installation.

Mechanical, electrical, and other work above the ceiling line shall be completed and approved prior to the start of acoustical ceiling installation. Acoustical work shall be provided complete with necessary fastenings, clips, and other accessories required for a complete installation. Mechanical fastenings shall not be exposed in the finished work. Hangers shall be laid out for each individual room or space. Hangers shall be placed to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Main runners and carrying channels shall be kept clear of abutting walls and partitions. At least two main runners shall be provided for each ceiling span. Wherever required to bypass an object with the hanger wires, a subsuspension system shall be installed, so that all hanger wires will be plumb.

3.1.1 Suspension System

Suspension system shall be installed in accordance with ASTM C 636 and as specified herein. There shall be no hanger wires or other loads suspended from underside of steel decking.

3.1.1.1 Plumb Hangers

Hangers shall be plumb and shall not press against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, hangers shall be provided at a minimum of four hangers per fixture and located not more than 150 mm from each corner of each fixture.

3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, the resulting horizontal force shall be offset by bracing, countersplaying, or other acceptable means.

3.1.2 Wall Molding

Wall molding shall be provided where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Wall molding shall be secured not more than 75 mm from ends of each length and not more than 400 mm on centers between end fastenings. Wall molding springs shall be provided at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Acoustical units shall be installed in accordance with the approved installation instructions of the manufacturer. Edges of acoustical units shall be in close contact with metal supports, with each other, and in true alignment. Acoustical units shall be arranged so that units less than one-half width are minimized. Units in exposed-grid system shall be held in place with manufacturer's standard hold-down clips, if units weigh less

than 5 kg per square m or if required for fire resistance rating.

3.1.4 Caulking

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings. See Section 07920 JOINT SEALANTS.

3.1.5 Adhesive Application

Wipe back of tile to remove accumulated dust. Daub acoustical units on back side with four equal daubs of adhesive. Apply daubs near corners of tiles. Contact area of each daub shall be at least 50 mm diameter in final position. Press units into place, aligning joints and abutting units tight and uniform without differences in joint widths.

3.2 CEILING ACCESS PANELS

Ceiling access panels shall be located directly under the items which require access.

3.3 CLEANING

Following installation, dirty or discolored surfaces of acoustical units shall be cleaned and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

3.4 RECLAMATION PROCEDURES

Ceiling tile, designated for recycling by the Contracting Officer, shall be neatly stacked on 1220 by 1220 mm pallets not higher than 1220 mm. Panels shall be completely dry. Pallets shall then be shrink wrapped and symmetrically stacked on top of each other without falling over. Disposal shall be in accordance with Section 01572 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT.

-- End of Section --

SECTION 09650

RESILIENT FLOORING

11/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 4078	(2002) Water Emulsion Floor Polish
ASTM E 648	(2003) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
ASTM F 1344	(2003a) Rubber Floor Tile
ASTM F 1482	(2003) Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring
ASTM F 1861	(2002) Resilient Wall Base
ASTM F 1869	(1998) Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
ASTM F 2169	(2002) Resilient Stair Treads
ASTM F 2170	(2002) Determining Relative Humidity in Concrete Floor Slabs in situ Probes
ASTM F 710	(2003) Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule #1168	(2003) Adhesive and Sealant Applications
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1.2 FIRE RESISTANCE REQUIREMENTS

Flooring in corridors and exits shall have a minimum average critical radiant flux of 0.22 watts per square centimeter when tested in accordance with ASTM E 648.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Resilient Flooring and Accessories; G

Scaled drawings indicating patterns (including location of patterns and colors) and dimensions.

SD-03 Product Data

Resilient Flooring and Accessories; G

Manufacturer's descriptive data.

Adhesives

Manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics. Material Safety Data Sheets (MSDS) for all primers and adhesives shall be provided to the Contracting Officer. Highlight VOC emissions.

SD-04 Samples

Resilient Flooring and Accessories; G

Three samples of each indicated color and type of flooring, base, mouldings, and accessories. Sample size shall be minimum 60 x 100 mm .

SD-06 Test Reports

Moisture, Alkalinity and Bond Tests; G

Copy of test reports of moisture and alkalinity content of concrete slab, and bond test stating date of test, person conducting the test, and the area tested.

SD-08 Manufacturer's Instructions

Surface Preparation
Installation

Manufacturer's printed installation instructions for all flooring materials and accessories, including preparation of substrate, seaming techniques, and recommended adhesives.

SD-10 Operation and Maintenance Data

Resilient Flooring and Accessories; G

Data Package 1 in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers bearing the manufacturer's name, style name, pattern color name and number, production run, project identification, and handling instructions. Materials shall be stored in a clean dry area with temperature maintained above 20 degrees C and below 30 degrees C , and shall be stacked according to manufacturer's recommendations. Materials shall be protected from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances. Do not open containers until materials are to be used, except for verification inspection. Observe ventilation and safety procedures specified in the MSDS.

1.5 ENVIRONMENTAL REQUIREMENTS

Areas to receive resilient flooring shall be maintained at a temperature above 20 degrees C and below 30 degrees C for 2 days before application, during application and 2 days after application, unless otherwise directed by the flooring manufacturer for the flooring being installed. A minimum temperature of 13 degrees C shall be maintained thereafter. Observe ventilation and safety procedures specified in the MSDS. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.

1.6 SCHEDULING

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

1.8 EXTRA MATERIALS

Extra flooring material of each color and pattern shall be furnished at the rate of 5 tiles for each 1000 tiles and 0.5 square meters for each 92 square meters of sheet flooring installed. Extra wall base material composed of 6 m of each type, color and pattern shall be furnished. All extra materials shall be packaged in original properly marked containers bearing the manufacturer's name, brand name, pattern color name and number, production run, and handling instructions. Extra materials shall be from the same lot as those installed. Leave extra stock at site in location as directed by Contracting Officer.

PART 2 PRODUCTS

2.1 RUBBER TILE

Rubber tile shall conform to ASTM F 1344 Class 1 homogeneous. Surface shall be smooth.

2.2 WALL BASE

Base shall conform to ASTM F 1861, Type TS (vulcanized thermoset rubber).

2.3 STAIR TREADS, RISERS, AND STRINGERS

Treads, risers, and stringers shall conform to ASTM F 2169 Type TS (vulcanized thermoset rubber). Surface of treads shall conform to ASTM F 2169 Class 1 smooth and have Group 1 abrasive non-slip strip. Nosing shall be square. Design shall be either a one piece nosing/tread/riser or a two piece nosing/tread with a matching coved riser.

2.4 MOULDING

Provide tapered mouldings of rubber as recommended by flooring manufacturer for both edges and transitions of flooring materials specified. Vertical lip on moulding shall not be greater than 6 mm. Change in level between 6 and 13 mm shall be beveled with a slope no greater than 1:2.

2.5 ADHESIVES

Adhesives for flooring, base and accessories shall be as recommended by the manufacturer and comply with local indoor air quality standards. VOC content must be less than the current VOC content limits of SCAQMD Rule #1168.

2.6 SURFACE PREPARATION MATERIALS

Surface preparation materials, such as panel type underlayment, lining felt, and floor crack fillers shall be as recommended by the flooring manufacturer for the subfloor conditions. Panel type underlayment products shall comply with ASTM F 1482.

2.7 POLISH/FINISH

Polish shall be as recommended by the manufacturer and conform to ASTM D 4078.

2.8 CAULKING AND SEALANTS

Caulking and sealants shall be in accordance with Section 07920 JOINT SEALANTS.

2.9 MANUFACTURER'S COLOR, PATTERN AND TEXTURE

Color, pattern and texture for resilient flooring and accessories shall be

in accordance with Section 09915 COLOR SCHEDULE. Color listed is not intended to limit the selection of equal colors from other manufacturers. Flooring in any one continuous area or replacement of damaged flooring in continuous area shall be from same production run with same shade and pattern.

PART 3 EXECUTION

3.1 EXAMINATION/VERIFICATION OF CONDITIONS

The Contractor shall examine and verify that site conditions are in agreement with the design package and shall report all conditions that will prevent a proper installation. The Contractor shall not take any corrective action without written permission from the Government. Work will proceed only when conditions have been corrected and accepted by the installer.

3.2 SURFACE PREPARATION

Flooring shall be in a smooth, true, level plane, except where indicated as sloped. Floor shall be flat to within 4.75 in 3048 mm. Subfloor shall be prepared in accordance with flooring manufacturers recommended instructions. The surfaces of lightweight concrete slabs (as defined by the flooring manufacturer) shall be prepared as recommended by the flooring manufacturer. Concrete subfloor preparation shall comply with ASTM F 710. Floor fills or toppings may be required as recommended by the flooring manufacturer. Underlayments when required by the flooring manufacturer shall be installed in accordance with manufacturer's recommended installation instructions. Panel type underlayments shall comply with ASTM F 1482. Before any work under this section is begun, all defects such as rough or scaling concrete, chalk and dust, cracks, low spots, high spots, and uneven surfaces shall have been corrected, and all damaged portions of concrete slabs shall have been repaired as recommended by the flooring manufacturer. Concrete curing and sealer compounds, other than the type that does not adversely affect adhesion, shall be entirely removed from the slabs. Paint, varnish, oils, release agents, sealers, waxers, and adhesives shall be removed, as recommended by the flooring manufacturer.

3.3 MOISTURE, ALKALINITY AND BOND TESTS

The suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content and pH level shall be determined by moisture and alkalinity tests and shall comply with manufacturers recommendations. Moisture testing shall be in accordance with ASTM F 1869 or ASTM F 2170 unless otherwise recommended by the flooring manufacturer. Alkalinity testing shall be as recommended by the flooring manufacturer. The compatibility of the resilient flooring adhesives to the concrete floors shall be determined by a bond test in accordance with the flooring manufacturers recommendations.

3.4 PLACING SHEET LINOLEUM FLOORING

Sheet linoleum flooring and accessories shall be installed in accordance with manufacturer's installation instructions. Adhesives shall be prepared

and applied in accordance with manufacturers directions. Flooring lines and joints shall be square, symmetrical, tight, and even. Keep each floor in true, level plane, except where slope is indicated. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Flooring shall be cut, fitted, and scribed to walls and partitions after field flooring has been applied. Seams shall be cut by overlapping or underscribing as recommended by the manufacturer. Finish joints flush, free from voids, recesses, and raised areas.

3.5 PLACING RUBBER TILE

Rubber tile and accessories shall be installed in accordance with manufacturer's installation instructions. Adhesives shall be prepared and applied in accordance with manufacturers directions. Flooring lines and joints shall be square, symmetrical, tight, and even. Keep each floor in true, level plane, except where slope is indicated. Vary width of edge tiles as necessary to maintain full-size tiles in field, but no edge tile shall be less than one-half full size, except where irregular-shaped rooms makes it impossible. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Flooring shall be cut, fitted, and scribed to walls and partitions after field flooring has been applied.

3.6 PLACING MOULDING

Provide moulding where flooring termination is higher than the adjacent finished flooring and at transitions between different flooring materials. When required, locate moulding under door centerline. Moulding is not required at doorways where thresholds are provided. Moulding shall be secured with adhesive as recommended by the manufacturer. Adhesives shall be prepared and applied in accordance with manufacturers directions.

3.7 PLACING WALL BASE

Wall base shall be installed in accordance with manufacturer's installation instructions. Adhesives shall be prepared and applied in accordance with manufacturers directions. Base joints shall be tight and base shall be even with adjacent resilient flooring. Voids along the top edge of base at masonry walls shall be filled with caulk. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners. Voids along the top edge of base at masonry walls shall be filled with caulk.

3.8 PLACING STAIR TREADS, RISERS, AND STRINGERS

Stair treads, risers, and stringers shall be securely attached and installed in accordance with manufacturer's installation instructions. Adhesives shall be prepared and applied in accordance with manufacturers directions. Treads and risers shall cover the full width of the stairs. Stairs wider than manufacturer's standard lengths shall have equal length pieces butted together to cover the treads. Installation shall include stringer angles on both the wall and banister sides, and landing trim.

3.9 CLEANING

Immediately upon completion of installation of flooring in a room or an area, flooring and adjacent surfaces shall be dry-cleaned to remove all surplus adhesive. Clean flooring as recommended in accordance with manufacturer's printed maintenance instructions. No sooner than 5 days after installation, flooring shall be washed with a nonalkaline cleaning solution, rinsed thoroughly with clear cold water, and, except for rubber flooring and stair treads, risers and stringers, vinyl and other flooring not requiring polish by manufacturer, given the number of coats of polish in accordance with manufacturers written instructions. All other flooring shall be cleaned and maintained as recommended by the manufacturer.

3.10 PROTECTION

From the time of laying until acceptance, flooring shall be protected from damage as recommended by the flooring manufacturer. Flooring which becomes damaged, loose, broken, or curled and wall base which is not tight to wall or securely adhered shall be removed and replaced.

-- End of Section --

SECTION 09680

CARPET
04/04

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 107	(2002) Colorfastness to Water
AATCC 134	(2001) Electrostatic Propensity of Carpets
AATCC 16	(1998) Colorfastness to Light
AATCC 165	(1999) Colorfastness to Crocking: Textile Floor Coverings - AATCC Crockmeter Method

ASTM INTERNATIONAL (ASTM)

ASTM D 1667	(1997) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam)
ASTM D 3278	(1996e1) Flash Point of Liquids by Small Scale Closed-Cup Apparatus
ASTM D 418	(1993) Pile Yarn Floor Covering Construction
ASTM D 5252	(1998a; R 2003) Operation of the Hexapod Drum Tester
ASTM D 5417	(1999; R 2003) Operation of the Vettermann Drum Tester
ASTM D 5793	(1995) Binding Sites Per Unit Length or Width of Pile Yarn Floor Coverings
ASTM D 5848	(1998) Mass Per Unit Area of Pile Yarn Floor Coverings
ASTM E 648	(2003) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

CARPET AND RUG INSTITUTE (CRI)

CRI 104 (2002) Standard for Installation
Specification of Commercial Carpet

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 2551 (1981) Machine-made Textile Floor
Coverings - Determination of Dimensional
Changes Due to the Effects of Varied Water
and Heat Conditions

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1630 Standard for the Surface Flammability of
Carpets and Rugs (FF 1-70)

40 CFR 247 Comprehensive Procurement Guideline for
Products Containing Recovered Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation
Molding

Three copies of drawings indicating areas receiving carpet, carpet types, textures and patterns, direction of pile, location of seams, and locations of edge molding.

SD-03 Product Data

Carpet

Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading, and flame resistance characteristics for each type of carpet material and installation accessory.

Surface Preparation
Installation

Three copies of the manufacturer's printed installation instructions for the carpet, including preparation of substrate, seaming techniques, and recommended adhesives and tapes.

Regulatory Requirements

Three copies of report stating that carpet contains recycled materials and/or involvement in a recycling or reuse program. Report shall include percentage of recycled material.

SD-04 Samples

Carpet
Molding

a. Carpet: Two "Production Quality" samples 450 x 450 mm of each carpet proposed for use, showing quality, pattern, and color specified.

b. Vinyl or Aluminum Moldings: Two pieces of each type at least 300 mm long.

c. Special Treatment Materials: Two samples showing system and installation method.

SD-06 Test Reports

Moisture and Alkalinity Tests

Three copies of test reports of moisture and alkalinity content of concrete slab stating date of test, person conducting the test, and the area tested.

SD-07 Certificates

Carpet

Certificates of compliance from a laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards and Technology attesting that each type of carpet and carpet with cushion material conforms to the standards specified.

Regulatory Requirements

Report stating that the carpet contains recycled materials and indicating the actual percentage of recycled material.

SD-10 Operation and Maintenance Data

Carpet
Cleaning and Protection

Three copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods, and cleaning cycles.

1.3 REGULATORY REQUIREMENTS

Carpet and adhesives shall bear the Carpet and Rug Institute (CRI) Indoor Air Quality (IAQ) label or demonstrate compliance with testing criteria and frequencies through independent laboratory test results. Carpet type bearing the label will indicate that the carpet has been tested and meets the criteria of the CRI IAQ Carpet Testing Program, and minimizes the impact on indoor air quality. Contractor shall procure carpet in accordance with 40 CFR 247. Carpet shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Where possible, product shall be purchased locally to reduce emissions of fossil fuels from transporting.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number, and related information. Materials shall be stored in a clean, dry, well ventilated area, protected from damage and soiling, and shall be maintained at a temperature above 16 degrees C for 2 days prior to installation.

1.5 ENVIRONMENTAL REQUIREMENTS

Areas in which carpeting is to be installed shall be maintained at a temperature above 16 degrees C for 2 days before installation, during installation, and for 2 days after installation. A minimum temperature of 13 degrees C shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties including minimum ten (10) year wear warranty, two (2) year material and workmanship and ten (10) year tuft bind and delamination.

1.7 EXTRA MATERIAL

Extra material from same dye lot consisting of uncut carpet tiles shall be provided for future maintenance. A minimum of 10 percent of total square meters of each carpet type, pattern, and color shall be provided.

PART 2 PRODUCTS

2.1 CARPET

Carpet shall be first quality; free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and manufacturing defects. Carpet materials and treatments shall be reasonably nonallergenic and free of other recognized health hazards. All grade carpets shall have a static control construction which gives adequate durability and performance. Carpet shall bear the Carpet and Rug Institute

(CRI) Indoor Air Quality (IAQ) Label. Carpet type bearing the label will indicate that carpet has been tested and meets the criteria of the CRI Green Label Requirements for Indoor Air Quality Test Criteria.

2.1.1 Physical Characteristics

2.1.1.1 MODULAR TILE CARPET CPT-1

Carpet shall comply with the following:

- a. Carpet Construction: Tufted.
- b. Type: Modular tile 450 x 450 mm square with 0.15 percent growth/shrink rate in accordance with ISO 2551.
- c. Pile Type: Level-loop.
- d. Pile Fiber: Commercial 100% branded (federally registered trademark) nylon continuous filament polypropylene.
- e. Pile or Wire Height: Average 4.7 mm in accordance with ASTM D 418.
- f. Gauge or Pitch: Minimum 39.4 pu/10 cm in accordance with ASTM D 5793.
- g. Finished Pile Yarn Weight: Minimum 4500 kg per square meter . This does not include weight of backings. Weight shall be determined in accordance with ASTM D 5848.
- h. Pile Density: Minimum 367.4 kg/cu m.
- i. Dye Method: Yarn dyed.
- j. Backing Materials: Primary backing materials shall be synthetic material.

Backing	Fiberglass Reinforced Composite Closed-Cell Vinyl Cushion		
Weight	35.5 oz/sq yd	1203 g/sq m	ASTM D 1667
Density	14 lbs/cu ft	224 kg/cu m	ASTM D 1667
Thickness	0.266 inch	6.76 mm	ASTM D 1667
Compression Set	Max. 10%		ASTM D 1667
Compression Deflection	Min. 5 lbs/sq inch @ 25%	Min. 352 g/sq cm	
	Max. 25 lbs/sq inch @ 25%	Max. 1758 g/sq cm	
RS Adhesive System	Microencapsulated Tackifier applied during manufacturing		

- k. Recycle Efforts: Use of nylon fiber with 25 per cent minimum recycled content.

2.1.1.2 MODULAR TILE CARPET CPT-2

Carpet shall comply with the following:

- a. Carpet Construction: Tufted.

- b. Type: 450 x 450 with 0.15 percent growth/shrink rate in accordance with ISO 2551.
- c. Pile Type: Level-loop.
- d. Pile Fiber: Commercial 100% branded (federally registered trademark) nylon continuous filament.
- e. Pile or Wire Height: Average 3.0 mm in accordance with ASTM D 418.
- f. Gauge or Pitch: Minimum 47.2 rows/10 cm in accordance with ASTM D 5793.
- g. Finished Pile Yarn Weight: Minimum 4500 g per square meter . This does not include weight of backings. Weight shall be determined in accordance with ASTM D 5848.
- h. Pile Density: Minimum 263.8 kg/cu m.
- i. Dye Method: Yarn dyed.
- j. Backing Materials: Primary backing materials shall be synthetic material.

Backing	Fiberglass Reinforced Composite Closed-Cell Vinyl Cushion		
Weight	35.5 oz/sq yd	1203 g/sq m	ASTM D 1667
Density	14 lbs/cu ft	224 kg/cu m	ASTM D 1667
Thickness	0.266 inch	6.76 mm	ASTM D 1667
Compression Set	Max. 10%		ASTM D 1667
Compression Deflection	Min. 5 lbs/sq inch @ 25%	Min. 352 g/sq cm	
	Max. 25 lbs/sq inch @ 25%	Max. 1758 g/sq cm	
RS Adhesive System	Microencapsulated Tackifier applied during manufacturing		

- k. Recycle Efforts: Use of nylon fiber with 25 per cent minimum recycled content.

2.1.1.3 MODULAR TILE CARPET CPT-3

Carpet shall comply with the following:

- a. Carpet Construction: Tufted.
- b. Type: Modular tile 450 x 450 mm square with 0.15 percent growth/shrink rate in accordance with ISO 2551.
- c. Pile Type: Level-loop.
- d. Pile Fiber: Commercial 100% branded nylon continuous filament.
- e. Pile or Wire Height: Average 4 mm.
- f. Gauge or Pitch: Minimum 39.4 mm in accordance with ASTM D 5793.

- g. Finished Pile Yarn Weight: Minimum 4500g per square meter . This does not include weight of backings. Weight shall be determined in accordance with ASTM D 5848.
- h. Pile Density: Minimum 376.7 kg/cu m.
- i. Dye Method: Yarn dyed.
- j. Backing Materials: Primary backing materials shall be those customarily used and accepted by the trade for each type of carpet synthetic material.

Backing	Fiberglass Reinforced Composite Closed-Cell Vinyl Cushion
Weight	35.5 oz/sq yd 1203 g/sq m ASTM D 1667
Density	14 lbs/cu ft 224 kg/cu m ASTM D 1667
Thickness	0.266 inch 6.76 mm ASTM D 1667
Compression Set	Max. 10% ASTM D 1667
Compression Deflection	Min. 5 lbs/sq inch @ 25% Min. 352 g/sq cm Max. 25 lbs/sq inch @ 25% Max. 1758 g/sq cm
RS Adhesive System	Microencapsulated Tackifier applied during manufacturing

- k. Recycle Efforts: Use of nylon fiber with 25 per cent minimum recycled content.

2.2 Performance Requirements

- a. ARR (Appearance Retention Rating): Carpet shall be tested and have the minimum 3.5-4.0 (Severe) ARR when tested in accordance with either the ASTM D 5252(Hexapod) or ASTM D 5417 (Vettermann) test methods using the number of cycles for short and long term tests as specified.
- b. Static Control: Static control shall be provided to permanently control static buildup to less than 3.5 kV when tested at 20 percent relative humidity and 21 degrees C in accordance with AATCC 134.
- c. Flammability and Critical Radiant Flux Requirements: Carpet shall comply with 16 CFR 1630. Carpet in corridors and exits shall have a minimum average critical radiant flux of 0.22 watts per square centimeter when tested in accordance with ASTM E 648.
- d. Tuft Bind: Tuft bind force required to pull a tuft or loop free from carpet backing shall be a minimum 40 N average force for loop pile.
- e. Colorfastness to Crocking: Dry and wet crocking shall comply with AATCC 165 and shall have a Class 4 minimum rating on the AATCC Color Transference Chart for all colors.
- f. Colorfastness to Light: Colorfastness to light shall comply with AATCC 16, Test Option E "Water-Cooled Xenon-Arc Lamp,

Continuous Light" and shall have a minimum 4 grey scale rating after 40 hours.

g. Colorfastness to Water: Colorfastness to water shall comply with AATCC 107 and have a minimum 4.0 gray scale rating and a minimum 4.0 transfer scale rating.

h.. Delamination Strength: Delamination strength for tufted carpet with a secondary back shall be minimum of 440 N/m .

2.3 ADHESIVES AND CONCRETE PRIMER

Adhesives and concrete primers for installation of carpet shall be waterproof, nonflammable, meet local air-quality standards, and shall be as required by the carpet manufacturer. Seam adhesive shall be waterproof, nonflammable, and nonstaining as recommended by the carpet manufacturer. Release adhesive for modular tile carpet shall be as recommended by the carpet manufacturer. Adhesives flashpoint shall be minimum 60 degrees C in accordance with ASTM D 3278.

2.4 MOLDING

Vinyl molding shall be heavy-duty and designed for the type of carpet being installed. Floor flange shall be a minimum 50 mm wide.

2.5 COLOR, TEXTURE, AND PATTERN

Color, texture, and pattern shall be in accordance with Section 09915 COLOR SCHEDULE.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Carpet shall not be installed on surfaces that are unsuitable and will prevent a proper installation. Holes, cracks, depressions, or rough areas shall be repaired using material recommended by the carpet or adhesive manufacturer. Floor shall be free of any foreign materials and swept broom clean. Before beginning work, subfloor shall be tested with glue and carpet to determine "open time" and bond.

3.2 MOISTURE AND ALKALINITY TESTS

Concrete slab shall be tested for moisture content and excessive alkalinity in accordance with CRI 104.

3.3 PREPARATION OF CONCRETE SUBFLOOR

Installation of the carpeting shall not commence until concrete substrate is at least 90 days old. The concrete surfaces shall be prepared in accordance with instructions of the carpet manufacturer. Type of concrete sealer, when required, shall be compatible with the carpet.

3.4 INSTALLATION

All work shall be performed by installers who are CFI certified (International Certified Floorcovering Installer Association), or manufacturer's approved installers. Installation shall be in accordance with the manufacturer's instructions and CRI 104. Edges of carpet meeting hard surface flooring shall be protected with molding; installation shall be in accordance with the molding manufacturer's instructions. Ventilation, personal protection, and other safety precautions recommended by the manufacturer of the adhesive shall be followed. Ventilation shall continue for at least 72 hours following installation.

3.4.1 Modular Tile Installation

Modular tiles shall be installed with release adhesive and shall be snugly jointed together. Tiles shall be laid in the same direction with accessibility to the subfloor where required.

3.4.2 Entrance Carpet Installation

Mats shall be cut to specified size and finished with a tapered vinyl edge that is glued and sewn on.

3.5 CLEANING AND PROTECTION

3.5.1 Cleaning

After installation of the carpet, debris, scraps, and other foreign matter shall be removed. Soiled spots and adhesive shall be removed from the face of the carpet with appropriate spot remover. Protruding face yarn shall be cut off and removed. Carpet shall be vacuumed clean.

3.5.2 Protection

The installed carpet shall be protected from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Edges of kraft paper protection shall be lapped and secured to provide a continuous cover. Traffic shall be restricted for at least 45 hours. Protective covering shall be removed when directed by the Contracting Officer.

3.6 REMNANTS

Remnants remaining from the installation, consisting of scrap pieces more than 600 mm in dimension with more than 0.6 square meters total, shall be provided. Non-retained scraps shall be removed from site and recycled appropriately.

-- End of Section --

SECTION 09720

WALLCOVERINGS

04/04

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 84 (2003) Surface Burning Characteristics of Building Materials

CHEMICAL FABRICS & FILM ASSOCIATION (CFFA)

CFFA-W-101-D (2000) Vinyl Coated Fabric Wallcovering

GYPSUM ASSOCIATION (GA)

GA 214 (1996) Recommended Levels of Gypsum Board Finish

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2003) International Building Code

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

UBC 42-2 (1991) Uniform Building Code Standard No. 42-2, Standard Test Method for Evaluating Room Fire Growth Contribution of Textile Wall Coverings

UBC 8-2 (1994) Uniform Building Code Standard No. 8-2, Standard Test Method for Evaluating Room Fire Growth Contribution of Textile Wall Coverings

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 265 (2002) Fire Tests for Evaluating Room Fire Growth Contribution of Textile Coverings on Full Height Panels and Walls

NFPA 286 (2000) Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule #1168

(2003) Adhesive and Sealant Applications

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wallcoverings and Accessories; G

Wallcovering manufacturer's descriptive data, documentation stating physical characteristics, flame resistance, mildew and germicidal characteristics. Corner guard and wainscot cap manufacturer's descriptive data.

Primer and Adhesive

Manufacturer's descriptive data, documentation stating physical characteristics, mildew and germicidal characteristics. Submit Material Safety Data Sheets (MSDS) for all primers and adhesives to the Contracting Officer. Highlight VOC emissions.

SD-04 Samples

Wallcoverings and Accessories; G

Three samples of each indicated type, pattern, and color of wallcovering. Samples of wallcovering shall be minimum 125 x 175 mm and of sufficient size to show pattern repeat.

Three samples of each indicated type of frame for presentation dry erase wallcovering. Samples shall be a minimum of 75 mm long.

Three samples of each indicated type corner guard and wainscot cap. Samples shall be a minimum of 75 mm long.

Vinyl Wallcovering Mockup Panels. After vinyl wallcovering samples are approved, and prior to starting installation, a minimum 2430 x 2430 mm vinyl wallcovering mock-up shall be provided for each color and type of vinyl wallcovering, using the proposed primers and adhesives and actual substrate materials. Once approved, the mock-up samples shall be used as a standard of workmanship for installation within the facility. At least 48 hours prior to mock-up installation, the Contractor shall submit written notification to the Contracting Officer's Representative.

SD-07 Certificates

Wallcoverings and Accessories

Manufacturer's statement attesting that the product furnished meets or exceeds specification requirements. The statement must; be dated after the award of the contract, state Contractor's name and address, name the project and location, and list the requirements being certified.

SD-08 Manufacturer's Instructions

Wallcoverings and Accessories

Preprinted installation instructions for wallcovering and accessories, adhesives and primers. Instructions shall include preparation of the substrate.

SD-10 Operation and Maintenance Data

Wallcoverings

Submit Data Package 1 in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

1.3 DELIVERY AND STORAGE

Deliver the material to the site in manufacturer's original wrappings and packages and clearly label with the manufacturer's name, brand name, pattern and color name and number, dye lot number, size, and other related information. Store in a safe, dry, clean, and well-ventilated area at temperatures not less than 10 degrees C and within a relative humidity range of 30 to 60 percent. Store wallcovering material in a flat position and protect from damage, soiling, and moisture. Do not open containers until needed for installation, unless verification inspection is required.

1.4 ENVIRONMENTAL REQUIREMENTS

Minimum temperature of area to receive wallcovering, before, during, and after installation, and requirements for conditioning adhesive and wallcovering shall comply with the wallcovering manufacturer's printed instructions. However, in no case shall the area temperature be less than 10 degrees C, 72 hours prior to, during installation, and until the adhesive is dry. A minimum temperature of 13 degrees C shall be maintained thereafter. Observe ventilation and safety procedures specified in the MSDS.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one-year period shall be provided.

1.6 EXTRA MATERIALS

Provide one linear meter of full-width wallcovering of each pattern and

color for each 36 linear meters of wallcovering installed. Extra stock shall be of the same manufacturer, type, pattern, color, and lot number as the installed wallcovering. Provide full rolls, packed for storage and marked with content, manufacturer's name, pattern and color name and number and dye lot number. Leave extra stock at the site at a location as directed by the Contracting Officer.

PART 2 PRODUCTS

2.1 WALLCOVERINGS

Wallcoverings and accessories shall be material designed specifically for the specified use. Vinyl wallcovering and borders shall be mercury, cadmium, lead, and chromium free. Wallcoverings shall contain bactericides and mildew inhibitors to protect against microbiological and mildew growth.

2.1.1 Vinyl Wallcovering

Vinyl wallcovering shall be vinyl coated woven or nonwoven fabric. Vinyl wallcovering shall conform to CFFA-W-101-D, Type II (Medium Duty) with a minimum total weight of 441 grams per square meter and 620 grams per linear meter. Width shall be 1320/1371 mm. Vinyl wallcovering shall be tested in accordance with NFPA 286 or have a Class A flame spread rating of 0-25 and smoke development rating of 0-450 when tested in accordance with ASTM E 84.

2.2 WALL LINER

Wall liner shall be a non-woven polyester cellulose blend having a minimum weight of 125 g/square meter and a total minimum thickness of 0.33 mm. Wall liner shall be tested in accordance with NFPA 286 or have a Class A flame spread rating of 0-25 and smoke development rating of 0-450 when tested in accordance with ASTM E 84.

2.3 PRIMER AND ADHESIVE

Primer and adhesive shall be of a type recommended by the wallcovering manufacturer, contain a non-mercury based mildewcide, and comply with local indoor air quality standards. VOC content must be less than the current VOC content limits of SCAQMD Rule #1168. Primer shall permit removal of the wallcovering and protect the wall surface during removal, gypsum wallboard facing paper shall not be damaged during removal of wallcovering. Adhesive shall be strippable. When required, primer and adhesive for textile wallcovering shall be of the type used for testing to comply with NFPA 265, UBC 42-2, or UBC 8-2 requirements. When substrate color variations show through vinyl wallcovering, a white pigmented primer as recommended by the wallcovering manufacturer shall be used to conceal the variations. Adhesive to install cornerguards and wainscot cap shall be of a type recommended by the manufacturer of the cornerguards and wainscot cap.

2.4 COLOR, TEXTURE, AND PATTERN

Unless otherwise noted, color shall be in accordance with Section 09915 COLOR SCHEDULE.

PART 3 EXECUTION

3.1 EXAMINATION

Contractor shall inspect all areas and conditions under which wallcoverings are to be installed. Contractor shall notify the Contracting Officer in writing of any conditions detrimental to the proper and timely completion of the installation. Work will proceed only when conditions have been corrected and accepted by the installer.

3.2 SURFACE PREPARATION

Walls shall be prepared for proper installation of wallcovering in accordance with wallcovering manufacturers instructions. Wallcovering shall not be applied to surfaces that are rough, that contain stains that will bleed through the wallcovering, or that are otherwise unsuitable for proper installation. Cracks and holes shall be filled and rough spots shall be sanded smooth. Walls to receive presentation dry erase wallcovering shall be finished to a Level 4 gypsum wallboard finish in accordance with GA 214 unless Level 5 is recommended by the wallcovering manufacturer. Surfaces to receive wallcovering shall be dry. Moisture content of gypsum wallboard, plaster, concrete, and masonry to receive wallcovering and the type of moisture meter used shall be as recommended by the wallcovering manufacturer. Plaster surfaces shall age at least 30 days prior to installation of vinyl wallcoverings. Interior surfaces of new and existing gypsum wallboard shall be primed with a wallcovering primer in accordance with the manufacturer's instructions. As required, white primer shall be used when substrate color variations are visible through thin or light color wallcovering. Interior surfaces of exterior masonry walls shall be sealed to prevent moisture penetration, then primed with a wallcovering primer in accordance with the manufacturer's instructions. Masonry walls shall have flush joints. Concrete and masonry walls shall be coated with a thin coat of joint compound or cement plaster as a substrate preparation. To promote adequate adhesion of wall lining over masonry walls, the walls shall be primed as recommended by the wall lining manufacturer. Primers and adhesives shall be prepared and applied in accordance with manufacturers instructions. Surface of walls shall be primed as required by wallcovering manufacturer's instructions to permit ultimate removal of wallcovering from the wall surface. Primer shall be allowed to completely dry before adhesive application.

3.3 INSTALLATION

3.3.1 Wall Liner

Wall liner shall be installed over masonry walls that are to receive wallcovering. Liner shall be installed in accordance with the manufacturer's installation instructions. Liner shall be installed perpendicular to wallcovering to prevent overlapping of seams between liner

and wallcovering.

3.3.2 Wallcovering

Wallcovering shall be installed in accordance with the manufacturer's installation instructions. When textile wallcoverings are specified to comply with NFPA 265, ICC IBC (Section 803.5.1 Textile Wall Coverings), UBC 42-2, or UBC 8-2 testing the wallcovering shall be installed in accordance with the manufacturer's installation instructions for compliance with the testing using the same product mounting system, including adhesive. Glue and adhesive spillage shall be immediately removed from wallcovering face and seams with a remover recommended by the manufacturer. After the installation is complete, the fabric and acoustical wallcovering shall be vacuumed with a ceiling to floor motion. Upon completion of presentation dry erase wallcovering installation, clean the wallcovering surface as recommended by the manufacturer prior to first use. When frame and tray are required for presentation dry erase wallcovering they shall be installed in accordance with manufacturer's installation instructions.

3.3.3 Corner Guards and Wainscot Cap

Corner guards and wainscot cap shall be installed where shown on the drawings and in accordance with the manufacturer's printed instructions. Corner guards shall run from top of base to 1220 mm in a continuous length.

3.4 CLEAN-UP

Upon completion of the work, wallcovering shall be left clean and free of dirt, soiling, stain, or residual film. Surplus materials, rubbish, and debris resulting from the wallcovering installation shall be removed and area shall be left clean.

-- End of Section --

SECTION 09900

PAINTS AND COATINGS

11/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 0100Doc (2001) Documentation of the Threshold
Limit Values and Biological Exposure
Indices

ASTM INTERNATIONAL (ASTM)

ASTM D 2092 (1995; R 2001e1) Preparation of
Zinc-Coated (Galvanized) Steel Surfaces
for Painting

ASTM D 4263 (1983; R 1999) Indicating Moisture in
Concrete by the Plastic Sheet Method

ASTM D 4444 (1992; R 2003) Use and Calibration of
Hand-Held Moisture Meters

ASTM D 523 (1989; R 1999) Specular Gloss

MASTER PAINTERS INSTITUTE (MPI)

MPI 107 (Jan 2004) Rust Inhibitive Primer
(Water-Based)

MPI 11 (Jan 2004) Exterior Latex, Semi-Gloss, MPI
Gloss Level 5

MPI 145 (Jan 2004) Institutional Low Odor / VOC
Interior Latex, MPI Gloss Level 3

MPI 147 (Jan 2004) Institutional Low Odor / VOC
Interior Latex, Semi-Gloss, MPI Gloss
Level 5

MPI 26 (Jan 2004) Cementitious Galvanized Metal
Primer

MPI 47 (Jan 2004) Interior Alkyd, Semi-Gloss, MPI
Gloss Level 5

MPI 50	(Jan 2004) Interior Latex Primer Sealer
MPI 79	(Jan 2004) Alkyd Anti-Corrosive Metal Primer

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SP01-01	(2000) Environmentally Preferable Product Specification for Architectural and Anti-Corrosive Paints
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THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Guide 3	(1982; R 1995) A Guide to Safety in Paint Application
SSPC PA 1	(2000) Shop, Field, and Maintenance Painting
SSPC QP 1	(1998; R 2000) Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Industrial Structures)
SSPC SP 1	(1982; R 2000) Solvent Cleaning
SSPC SP 10	(2000) Near-White Blast Cleaning
SSPC SP 12	(2002) Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating
SSPC SP 2	(1982; R 2000) Hand Tool Cleaning
SSPC SP 3	(1982; R 2000) Power Tool Cleaning
SSPC SP 6	(2000) Commercial Blast Cleaning
SSPC SP 7	(2000) Brush-Off Blast Cleaning
SSPC VIS 1	(2002) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC VIS 3	(1993) Visual Standard for Power-and Hand-Tool Cleaned Steel
SSPC VIS 4	(2001) Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) Safety -- Safety and Health Requirements
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U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-313 (Rev D; Am 1) Material Safety Data,
Transportation Data and Disposal Data for
Hazardous Materials Furnished to
Government Activities

FED-STD-595 (Rev B; Am 1) Colors, Volume 1

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000 Air Contaminants

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

Samples of specified materials may be taken and tested for compliance with specification requirements.

In keeping with the intent of Executive Order 13101, "Greening the Government through Waste Prevention, Recycling, and Federal Acquisition", products certified by SCS as meeting SCS SP01-01 shall be given preferential consideration over registered products. Products that are registered shall be given preferential consideration over products not carrying any EPP designation.

SD-02 Shop Drawings

Piping identification

Submit color stencil codes

SD-03 Product Data

Coating; G

Manufacturer's Technical Data Sheets

Sealant

SD-04 Samples

Color; G

Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated.

Textured Wall Coating System; G

Sample Textured Wall Coating System Mock-Up; G

SD-07 Certificates

Applicator's qualifications

Qualification Testing laboratory for coatings G

SD-08 Manufacturer's Instructions

Application instructions

Mixing

Detailed mixing instructions, minimum and maximum application temperature and humidity, potlife, and curing and drying times between coats.

Manufacturer's Material Safety Data Sheets

Submit manufacturer's Material Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

SD-10 Operation and Maintenance Data

Coatings: G

Preprinted cleaning and maintenance instructions for all coating systems shall be provided.

1.3 APPLICATOR'S QUALIFICATIONS

1.3.1 Contractor Qualification

Submit the name, address, telephone number, FAX number, and e-mail address of the contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on a minimum of three similar projects within the past three years. List information by individual and include the following:

- a. Name of individual and proposed position for this work.
- b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address, telephone number, and telex number (if non-US) of facility owner

Name of individual in facility owner's organization who can be contacted as a reference

Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

1.3.2 SSPC QP 1 Certification

All contractors and subcontractors that perform surface preparation or coating application shall be certified by the Society for Protective Coatings (formerly Steel Structures Painting Council) (SSPC) to the requirements of SSPC QP 1 prior to contract award, and shall remain certified while accomplishing any surface preparation or coating application. The painting contractors and painting subcontractors must remain so certified for the duration of the project. If a contractor's or subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in contractor certification status.

1.4 QUALITY ASSURANCE

1.4.1 Field Samples and Tests

The Contracting Officer may choose up to two coatings that have been delivered to the site to be tested at no cost to the Government. Take samples of each chosen product as specified in the paragraph "Sampling Procedures." Test each chosen product as specified in the paragraph "Testing Procedure." Products which do not conform, shall be removed from the job site and replaced with new products that conform to the referenced specification. Testing of replacement products that failed initial testing shall be at no cost to the Government.

Another required testing is Batch Quality Conformance Testing to prove conformance of the manufacturer's paint to the specified MPI standard. This testing is accomplished before the materials are delivered to the job

site. Provide testing for all paint products. Test paint products as specified in the paragraph "Testing Procedure".

1.4.1.1 Sampling Procedure

The Contracting Officer will select paint at random from the products that have been delivered to the job site for sample testing. The Contractor shall provide one liter samples of the selected paint materials. The samples shall be taken in the presence of the Contracting Officer, and labeled, identifying each sample. Provide labels in accordance with the paragraph "Packaging, Labeling, and Storage" of this specification.

1.4.1.2 Testing Procedure

Provide Batch Quality Conformance Testing for specified products, as defined by and performed by MPI. As an alternative to Batch Quality Conformance Testing, the Contractor may provide Qualification Testing for specified products above to the appropriate MPI product specification, using the third-party laboratory approved under the paragraph "Qualification Testing" laboratory for coatings. The qualification testing lab report shall include the backup data and summary of the test results. The summary shall list all of the reference specification requirements and the result of each test. The summary shall clearly indicate whether the tested paint meets each test requirement. Note that Qualification Testing may take 4 to 6 weeks to perform, due to the extent of testing required.

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that employees performing testing are qualified. If the Contractor chooses MPI to perform the Batch Quality Conformance testing, the above submittal information is not required, only a letter is required from the Contractor stating that MPI will perform the testing.

1.4.2 Textured Wall Coating System

Three complete samples of the indicated type, pattern, and color of textured wall coating system applied to a panel of the same material as that on which the coating system will be applied in the work. Samples of wall coating systems shall be minimum 125 x 175 mm (5 x 7 inches) and of sufficient size to show pattern repeat and texture.

1.4.3 Sample Textured Wall Coating System Mock-Up

After coating samples are approved, and prior to starting installation, a minimum 2430 mm x 2430 mm (8 foot x 8 foot) mock-up shall be provided for the textured wall coating, using the actual substrate materials. Once approved the mock-up samples shall be used as a standard of workmanship for installation within the facility. At least 48 hours prior to mock-up installation, the Contractor shall submit written notification to the Contracting Officer's Representative.

1.5 REGULATORY REQUIREMENTS

1.5.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

1.5.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.5.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.5.4 Asbestos Content

Materials shall not contain asbestos.

1.5.5 Mercury Content

Materials shall not contain mercury or mercury compounds.

1.5.6 Silica

Abrasive blast media shall not contain free crystalline silica.

1.5.7 Human Carcinogens

Materials shall not contain ACGIH 0100Doc and ACGIH 0100Doc confirmed human carcinogens (A1) or suspected human carcinogens (A2).

1.6 PACKAGING, LABELING, AND STORAGE

Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Pigmented paints shall be furnished in containers not larger than 20 liters. Paints and thinners shall be stored in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 4 to 35 degrees C.

1.7 SAFETY AND HEALTH

Apply coating materials using safety methods and equipment in accordance with the following:

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in Section 01525 SAFETY AND OCCUPATIONAL HEALTH REQUIREMENTS and in Appendix A of EM 385-1-1. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.7.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC Guide 3.

1.7.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

- a. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
- b. 29 CFR 1910.1000.
- c. ACGIH 0100Doc, threshold limit values.

1.8 ENVIRONMENTAL CONDITIONS

1.8.1 Coatings

Do not apply coating when air or substrate conditions are:

- a. Less than 3 degrees C above dew point;
- b. Below 10 degrees C or over 35 degrees C, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

1.9 COLOR SELECTION

Color Coding for Shore-to-Ship Utility Connections

<u>Service</u>	<u>Color</u>	<u>FED-STD-595 No.</u>
Potable Water*	Blue	15044
Water Provided for Fire Protection**	Red	11105
Chilled Water	Striped Blue/White	15044/17886
Oily Waste Water	Striped Yellow/Black	13538/17038

Color Coding for Shore-to-Ship
Utility Connections

<u>Service</u>	<u>Color</u>	<u>FED-STD-595 No.</u>
Sewer	Gold	17043
Steam	White	17886
High Pressure Air	Gray	16081
Low Pressure Air	Tan	10324
Fuel	Yellow	13655

* This includes connections serving domestic functions.

** This includes non-potable salt water or, at some locations, fresh water connections provided for fire protection (may also include flushing and cooling requirements). Note: This does not include waterfront fire hydrants.

Colors of finish coats shall be as indicated or specified in Section 09915.

Tint each coat progressively darker to enable confirmation of the number of coats.

Color, texture, and pattern of wall coating systems shall be in accordance with Section 09915 COLOR SCHEDULE.

1.10 LOCATION AND SURFACE TYPE TO BE PAINTED

1.10.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

- a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.
- b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.
- c. Existing coated surfaces that are damaged during performance of the work.

1.10.1.1 Exterior Painting

Includes new surfaces of the building and appurtenances. Also included are existing coated surfaces made bare by cleaning operations.

1.10.1.2 Interior Painting

Includes new surfaces of the building and appurtenances as indicated. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

- a. Exposed columns, girders, beams, joists, and metal deck; and
- b. Other contiguous surfaces.

1.10.2 Painting Excluded

Do not paint the following unless indicated otherwise.

- a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.
- b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.
- c. Steel to be embedded in concrete.
- d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.
- e. Hardware, fittings, and other factory finished items.

1.10.3 Mechanical and Electrical Painting

Includes field coating of interior new surfaces.

- a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.
 - (1) Exposed piping, conduit, and ductwork;
 - (2) Supports, hangers, air grilles, and registers;
 - (3) Miscellaneous metalwork and insulation coverings.
- b. Do not paint the following, unless indicated otherwise:
 - (1) New zinc-coated, aluminum, and copper surfaces under insulation
 - (2) New aluminum jacket on piping
 - (3) New interior ferrous piping under insulation.

1.10.4 Exterior Painting of Site Work Items

Field coat the following items:

New Surfaces

- a. Exterior stair guardrails
- b. Exterior Stair Stringers
- c. Structural members of stair landing

1.10.5 Definitions and Abbreviations

1.10.5.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

1.10.5.2 Batch Quality Conformance Testing

Batch quality conformance testing determines that the product provided is the same as the product qualified to the appropriate product specification. This testing shall only be accomplished by MPI testing lab.

1.10.5.3 Coating

A film or thin layer applied to a base material called a substrate. A coating may be a metal, alloy, paint, or solid/liquid suspensions on various substrates (metals, plastics, wood, paper, leather, cloth, etc.). They may be applied by electrolysis, vapor deposition, vacuum, or mechanical means such as brushing, spraying, calendering, and roller coating. A coating may be applied for aesthetic or protective purposes or both. The term "coating" as used herein includes emulsions, enamels, stains, varnishes, sealers, epoxies, and other coatings, whether used as primer, intermediate, or finish coat. The terms paint and coating are used interchangeably.

1.10.5.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

1.10.5.5 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five (5) levels are generically defined under the Assessment sections in the MPI Maintenance Repainting Manual.

1.10.5.6 EPP

Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

1.10.5.7 EXT

MPI short term designation for an exterior coating system.

1.10.5.8 INT

MPI short term designation for an interior coating system.

1.10.5.9 micron / microns

The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

1.10.5.10 mil / mils

The English measurement for 0.001 in or one/one-thousandth of an inch, equal to 25.4 microns or 0.0254 mm.

1.10.5.11 mm

The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

1.10.5.12 MPI Gloss Levels

MPI system of defining gloss. Seven (7) gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte or Flat	0 to 5	10 max
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 min
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

Gloss is tested in accordance with ASTM D 523. Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

1.10.5.13 MPI System Number

The MPI coating system number in each Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN). The Division number follows the CSI Master Format.

1.10.5.14 Paint

See Coating definition.

1.10.5.15 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

1.10.5.16 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.2 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.3 PREPARATION OF METAL SURFACES

3.3.1 New Ferrous Surfaces

- a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances:
Solvent clean or detergent wash in accordance with SSPC SP 1 to

remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 2. Brush-off blast remaining surface in accordance with SSPC SP 7; Water jetting to SSPC SP 12 WJ-4 may be used to remove loose coating and other loose materials. Use inhibitor as recommended by coating manufacturer to prevent premature rusting. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

- b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with SSPC SP 6/SSPC SP 12 WJ-3.

3.3.2 Final Ferrous Surface Condition:

For tool cleaned surfaces, the requirements are stated in SSPC SP 2 and SSPC SP 3. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 3.

For abrasive blast cleaned surfaces, the requirements are stated in SSPC SP 7, SSPC SP 6, and SSPC SP 10. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 1.

For waterjet cleaned surfaces, the requirements are stated in SSPC SP 12. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 4.

3.3.3 Galvanized Surfaces

- a. New or Existing Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with solvent, steam, or non-alkaline detergent solution in accordance with SSPC SP 1. If the galvanized metal has been passivated or stabilized, the coating shall be completely removed by brush-off abrasive blast. New galvanized steel to be coated shall not be "passivated" or "stabilized" If the absence of hexavalent stain inhibitors is not documented, test as described in ASTM D 2092, Appendix X2, and remove by one of the methods described therein.

3.4 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

3.4.1 Gypsum Board, Plaster, and Stucco

- a. Surface Cleaning: Plaster and stucco shall be clean and free from loose matter; gypsum board shall be dry. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be used if paint will be water-based.
- b. Repair of Minor Defects: Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.
- c. Allowable Moisture Content: Latex coatings may be applied to damp

surfaces, but not surfaces with droplets of water. Do not apply epoxies to damp surfaces as determined by ASTM D 4263. New plaster to be coated shall have a maximum moisture content of 8 percent, when measured in accordance with ASTM D 4444, Method A, unless otherwise authorized. In addition to moisture content requirements, allow new plaster to age a minimum of 30 days before preparation for painting.

3.5 APPLICATION

3.5.1 Coating Application

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.

At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application.

Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated.

Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

Thoroughly work coating materials into joints, crevices, and open spaces. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.

Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

Apply paint to exposed new fire extinguishing sprinkler system in mechanical rooms including valves, piping, conduit, hangers, supports, miscellaneous metal work, and accessories. Shield sprinkler heads with protective coverings while painting is in progress. Remove sprinkler heads which have been painted and replace with new sprinkler heads. For piping in unfinished spaces, provide primed surfaces with one coat of red alkyd gloss enamel to a minimum dry film thickness of 0.025 mm. Unfinished spaces include attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and space where walls or ceiling are not painted or not constructed of a prefinished material. For piping in finished areas, provide prime surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one

coat of red alkyd gloss enamel. Upon completion of painting, remove protective covering from sprinkler heads.

- a. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.
- b. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover surface of preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.
- c. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.
- d. Thermosetting Paints: Topcoats over thermosetting paints (epoxies and urethanes) should be applied within the overcoating window recommended by the manufacturer.

3.5.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

When thinning is allowed, paints shall be thinned immediately prior to application with not more than 0.125 L of suitable thinner per liter. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.5.3 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.5.4 Coating Systems

- a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table

Division 5. Exterior Metal, Ferrous and Non-Ferrous Paint Table
Division 5. Interior Metal, Ferrous and Non-Ferrous Paint Table
Division 9: Interior Plaster, Gypsum Board, Textured Surfaces
Paint Table

- b. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 0.038 mm each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.
- c. Coatings for Surfaces Not Specified Otherwise: Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.
- d. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:
 - (1) One coat of primer.
 - (2) One coat of undercoat or intermediate coat.
 - (3) One topcoat to match adjacent surfaces.
- e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

3.6 COATING SYSTEMS FOR METAL

Apply coatings of Tables in Division 5 for Exterior and Interior.

- a. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.
- b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.
- c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.
- d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 0.038 mm DFT immediately prior to application of epoxy or urethane coatings.
- e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

- f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

3.7 PAINT TABLES

All DFT's are minimum values.

3.7.1 EXTERIOR PAINT TABLES

DIVISION 5: EXTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

EXTERIOR GALVANIZED SURFACES

F. New Galvanized surfaces:

1. MPI EXT 5.3A-G5 (Semigloss)
- | | | |
|-------------|---------------|----------|
| Primer: | Intermediate: | Topcoat: |
| MPI 26 | MPI 11 | MPI 11 |
| System DFT: | 112 microns | |

3.7.2 INTERIOR PAINT TABLES

DIVISION 5: INTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

INTERIOR STEEL / FERROUS SURFACES

- A. Metal, Mechanical, Electrical, Fire extinguishing sprinkler systems including valves, conduit, hangers, supports, Surfaces adjacent to painted surfaces (Match surrounding finish), exposed copper piping, and miscellaneous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment:

2. MPI INT 5.1E-G5 (Semigloss)
- | | | |
|-------------|---------------|----------|
| Primer: | Intermediate: | Topcoat: |
| MPI 79 | MPI 47 | MPI 47 |
| System DFT: | | |

DIVISION 9: GYPSUM BOARD, TEXTURED SURFACES PAINT TABLE

- A. New and Existing, previously painted Plaster and Wallboard not otherwise specified:

3. New; MPI INT 9.2M-G3 (Eggshell) / Existing; MPI RIN 9.2M-G3 (Eggshell)
- | | | |
|-------------|---------------|----------|
| Primer: | Intermediate: | Topcoat: |
| MPI 50 | MPI 145 | MPI 145 |
| System DFT: | 100 microns | |

New; MPI INT 9.2M-G5 (Semigloss) / Existing; MPI RIN 9.2M-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 147	MPI 147
System DFT:	100 microns	

-- End of Section --

SECTION 09915

COLOR SCHEDULE
08/02

PART 1 GENERAL

1.1 GENERAL

This section covers only the color of the exterior and interior materials and products that are exposed to view in the finished construction. The word "color" as used herein includes surface color and pattern. Requirements for quality and method of installation are covered in other appropriate sections of the specifications. Specific locations where the various materials are required are shown on the drawings. Items not designated for color in this section may be specified in other sections. When color is not designated for items, the Contractor shall propose a color for approval.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Samples

Color Schedule

3 sets of color boards, 90 days after the Contractor is given Notice to proceed, complying with the following requirements:

- a. Color boards shall reflect all actual finish textures, patterns, and colors required for this contract.
- b. Materials shall be labeled with the finish type, manufacturer's name, pattern, and color reference.
- c. Samples shall be on size 8-1/2 by 11 inch boards with a maximum spread of size 25-1/2 by 33 inches for foldouts.
- d. Samples for this color board are required in addition to samples requested in other specification sections.

e. Color boards shall be submitted to the Contracting Officer.

PART 2 PRODUCTS

2.1 REFERENCE TO MANUFACTURER'S COLOR

Where color is shown as being specific to one manufacturer, an equivalent color by another manufacturer may be submitted for approval. Manufacturers and materials specified are not intended to limit the selection of equal colors from other manufacturers.

2.2 COLOR SCHEDULE

The color schedule lists the colors, patterns and textures required for interior finishes, including both factory applied and field applied colors.

2.2.1 Interior Floor Finishes

Flooring materials shall be provided to match the colors listed below.

2.2.1.1 Carpet Tile:

(CPT-1) Collins & Aikman, Pattern Soma Color 65009 Dijon,
(CPT-2) Collins & Aikman, Pattern Synapse, Color 71009 Dijon,
(CPT-3) Collins & Aikman, Pattern Timeless, Color 39825 Charcoal.

2.2.1.2 Sheet Linoleum:

(LIN) Tarkett, Style Toscano, Color 5504.

2.2.1.3 Rubber Tile:

(RT) Johnsonite, Style Hammered (HRT), Color 92 Blue Lagoon.

2.2.1.4 Stair Treads, Kick Strips, and Risers:

(RST) Johnsonite, Style Stairtreads - Hammered with Grit Tape
(VIHTRSPS); Risers - Hammered (HRT).

2.2.1.5 Porcelain Tile:

(PT-1) Daltile, Pattern Portenza, Color PZ05 Verde Lago.

2.2.1.6 Grout:

(FG) Custom Building Products, Style 100% Epoxy Grout, Color #335 Winter Grey.

2.2.1.7 Concrete Sealed:

(SC)

2.2.2 Interior Base Finishes

Base materials shall be provided to match the colors listed below.

2.2.2.1 Resilient Base and Moldings:

(RB)-1) Johnsonite, Style 4" DC Rubber Wall Base, Color 92 Blue Lagoon.
(RB-2) Roppe, Style Visuelle Wall Base, Color P139 Deep Navy.

(RB-3) Roppe, Style Visuelle Wall Base, Color P177 Steel Blue.
(RB-4) Roppe, Style 4" Cove Rubber Base TS RP177, Color P177, Steel Blue.

2.2.2.2 Porcelain Tile:

(PT-2) Daltile, Style Portenza S-43G9, Color PZ05 Verde Lago

2.2.2.3 Grout:

(WG-1) Custom Building Products, Style 100%-Epoxy Grout, Color #386 Oyster Gray.

2.2.2.4 Metal Stringers for Stairs:

(P-7) Pittsburgh Paints, Semi-gloss Enamel, Color Sailor's Coat 552-1.

2.2.3 Interior Wall Finishes

Interior wall color shall apply to the entire wall surface, including reveals, vertical furred spaces, grilles, diffusers, electrical and access panels, and piping and conduit adjacent to wall surfaces unless otherwise specified. Items not specified in other paragraphs shall be painted to match adjacent wall surface. Wall materials shall be provided to match the colors listed below.

2.2.3.1 Paint:

(P-3) Pittsburgh Paints, Eggshell Enamel, Color Alabaster 513-3.
(P-4) Pittsburgh Paints, Semigloss Enamel, Color Brandied Pears 315-2.

2.2.3.2 Vinyl Wall Covering:

(WC-1) Kerosal Wallcovering, Pattern Bagatelle, Color Metal Mist B621-95.

2.2.3.3 Fiberglass Mesh Covering:

(WC-2) RJF International, Style G135N; Color White, Painted.

2.2.3.4 Porcelain Tile:

(PT-3) Daltile, Portenza 3" Mesh, Color P205 Verde Lago.
(PT-4) Daltile, Porcelto 8", Color CD13 Gergio.
(PT-5) Daltile, Porcelto 8", Color CD28 Bianco Ghiaccio.
(PT-6) Daltile, Porcelto 8", Color CD29 Bianco.

2.2.3.5 Ceramic Tile Grout:

(WG-1) Custom Building Products, Style 100%, Epoxy Grout, Color #386, Oyster Gray.
(WG-2) Custom Building Products, Style 100%. Epoxy Grout, Color #382 Bone.

2.2.4 Interior Ceiling Finishes

Ceiling colors shall apply to ceiling surfaces including soffits, furred down areas, grilles, diffusers, registers, and access panels. Ceiling color shall also apply to joist, underside of roof deck, and conduit and piping where joists and deck are exposed and required to be painted.

Ceiling materials shall be provided to match the colors listed below.

- 2.2.4.1 Acoustical Tile and Grid:
 - (ACT) USG, Style Millenium Clima Plus, Color White.
 - (CG) USG, Style Centriciti DXT26, Color White.
- 2.2.4.2 Paint:
 - (P-1) Pittsburgh Paints, Eggshell Enamel, Color Ice Castles 552-1.
 - (P-2) Pittsburgh Paints, Eggshell Enamel, Color Pegasus 517-1.
- 2.2.4.3 Structural Framing Stairwell:
 - (P-7) Pittsburgh Paints, Semi-gloss Enamel, Color Sailors Coat 552-1.

2.2.5 Interior Trim

Interior trim shall be provided to match the colors listed below.

- 2.2.5.1 Steel Doors:
 - (P-3) Pittsburgh Paints, Eggshell Enamel, Color Alabaster 513-3.
- 2.2.5.2 Steel Door Frames:
 - (P-5) Pittsburgh Paints, Semi-gloss Enamel, Color Mother of Pearl 513-1.
- 2.2.5.3 Wood Door Frames:
 - (P-5) Pittsburgh Paints, Semi-gloss Enamel, Color Mother of Pearl 513-1.
 - (P-6) Pittsburgh Paints, Semi-gloss Enamel, Color Feldspar 554-5.
- 2.2.5.4 Wood Stain:
 - Natural Beech Finish, to match casework and furnishings.
- 2.2.5.5 Window Sills:
 - (SS-3) Corian, Color Macadam.
- 2.2.5.6 Fire Extinguisher Cabinets:
 - (P-6) Pittsburgh Paints, Semi-gloss Enamel, Color Feldspar 554-5.
 - (P-3) Pittsburgh Paints, Semi-gloss Enamel, Color Mabaster 513-3.
- 2.2.5.7 Handrails:
 - (P-7) Pittsburgh Paints, Semi-gloss Enamel, Color Sailors Coat 552-7.
- 2.2.5.8 Metal Stairs:
 - (P-7) Pittsburgh Paints, Semi-gloss Enamel, Color Sailors Coat 552-7.
- 2.2.5.9 Closet Shelving:
 - (P-5) Pittsburgh Paints, Semi-gloss Enamel, Color Mother of Pearl 513-1.
- 2.2.5.10 Benches:
 - Wood, Stained to match furniture, doors, casework.

2.2.6 Interior Window Treatment

Window treatments shall be provided to match the colors listed below.

- 2.2.6.1 Horizontal Blinds:
Hunter Douglas, 1" lightlines, Color #1, 068 Creme de la Creme,
Color #2, 018 Satin Silver.
- 2.2.6.2 Drapery Hardware:
(P-5) Pittsburgh Paints, Semi-gloss Enamel, Color Mother of Pearl,
513-1.
- 2.2.6.3 Window Shades:
Vimco Rolldown Shades, Blackout Premier Color Sahel.

2.2.7 Interior Miscellaneous

Miscellaneous items shall be provided to match the colors listed below.

- 2.2.7.1 Solid Surfacing Material:
(SS-1) Corain, Color Fossil.
(SS-2) Corian, Color Matterhorn.
(SS-3) Corian, Color Macadam.
- 2.2.7.2 Casework:
HTH, Classic Birch, Solid Wood Doors Collection.
- 2.2.7.3 Casework Hardware
HTH, Steel Modern
- 2.2.7.4 Signage Message Color (excluding handicapped signage):
White.
- 2.2.7.5 Signage Background Color (excluding handicapped signage):
Dark Blue.
- 2.2.7.6 Corner Guards:
Clear Acrylic.
- 2.2.7.7 Wall Switch Handles and Standard Receptacle Bodies:
Paint to match adjacent wall surface.
- 2.2.7.8 Electrical Device Cover Plates:
Paint to match adjacent wall surface.
- 2.2.7.9 Electrical Panels:
Paint to match wall on which it is located.
- 2.2.7.10 Shower Curtain:
American Hotel Register, A58 Shadow, Color Natural.
- 2.2.7.11 Shower Wall Kits, Trim and Shower Pan:
White.

2.2.7.12 Lockers
Design Tec Stock Colors, E 0-02 Silver Grey.

2.3 PLACEMENT SCHEDULE

Refer to drawings.

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION 10260

WALL AND CORNER GUARDS
10/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 256	(2002e1) Determining the Izod Pendulum Impact Resistance of Plastics
ASTM D 543	(1995; R 2001) Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D 635	(2003) Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
ASTM E 84	(2003) Surface Burning Characteristics of Building Materials
ASTM G 21	(1996; R 2002) Determining Resistance of Synthetic Polymeric Materials to Fungi
ASTM G 22	(1976; R 1996) Determining Resistance of Plastics to Bacteria

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1545	(1986) Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Corner Guards

Wall Guards (Bumper Guards)
Door Protectors
Wall Covering/Panels

Drawings indicating locations and typical elevations of each type of item. Drawings shall show vertical and horizontal dimensions, full size sections, thickness of materials, and fastening details.

SD-03 Product Data

Corner Guards

Manufacturer's descriptive data, catalog cuts, installation instructions, and recommended cleaning instructions.

SD-04 Samples

Finish

Submit three samples indicating color and texture of materials requiring color and finish.

SD-06 Test Reports

Corner Guards

Fire rating and extinguishing test results for resilient material.

SD-07 Certificates

Corner Guards

Statements attesting that the items comply with specified fire and safety code requirements.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Materials shall be kept dry, protected from weather and damage, and stored under cover. Materials shall be stored at approximately 21 degrees C for at least 48 hours prior to installation.

1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 GENERAL

To the maximum extent possible, corner guards, shall be the standard products of a single manufacturer and shall be furnished as detailed. Drawings show general configuration of products required, and items differing in minor details from those shown will be acceptable.

2.1.1 Resilient Material

2.1.1.1 Minimum Impact Resistance

Minimum impact resistance shall be 960.8 N.m/m (18 ft. lb/sq. inch) when tested in accordance with ASTM D 256, (Izod impact, ft. lbs per sq inch notched).

2.1.1.2 Fire Rating

Fire rating shall be Class 1 when tested in accordance with ASTM E 84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less. Material shall be rated self extinguishing when tested in accordance with ASTM D 635. Material shall be labeled and tested by an approved nationally known testing laboratory. Resilient material used for protection on fire rated doors and frames shall be listed by the testing laboratory performing the tests. Resilient material installed on fire rated wood/steel door and frame assemblies shall have been tested on similar type assemblies. Test results of material tested on any other combination of door/frame assembly will not be acceptable.

2.1.1.3 Chemical and Stain Resistance

Materials shall be resistant to chemicals and stains reagents in accordance with ASTM D 543.

2.1.1.4 Fungal and Bacterial Resistance

Materials shall be resistant to fungi and bacteria in accordance with ASTM G 21 or ASTM G 22, as applicable.

2.2 CORNER GUARDS

2.2.1 Resilient Corner Guards

Corner guard units shall be surface mounted type, radius formed to profile shown. Corner guards shall be 1220 mm high. Mounting hardware shall be furnished. Clear corner guards shall be extruded from polycarbonate material with an impact resistance of 16 ft. lb./inch as tested per ASTM D 256, Notched Izod Test. Thickness to be 2.2 mm for 50.8 mm. Surface mounted polycarbonate corner guards mounted with screws.

2.3 TRIM, FASTENERS AND ANCHORS

Vinyl trim, fasteners and anchors shall be provided for each specific

installation as shown. All fasteners to be non-corrosive and compatible with polycarbonate. All necessary fasteners to be supplied by the manufacturer. Attachment hardware shall be appropriate for wall construction.

2.4 FINISH

2.4.1 Resilient Material Finish

Finish for resilient material shall be embossed texture with colors in accordance with SAE J1545.

2.5 ADHESIVES

Adhesive for resilient material shall be in accordance with manufacturers recommendations.

2.6 COLOR

Color shall be in accordance with Section 09915 COLOR SCHEDULE. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Corner Guards and Wall Guards (Bumper Guards)

Material shall be mounted at location indicated in accordance with manufacturer's recommendations.

-- End of Section --

SECTION 10440

INTERIOR SIGNAGE

07/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 605 (1998) Voluntary Specification,
Performance Requirements and Test
Procedures for High Performance Organic
Coatings on Aluminum Extrusions and Panels

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1984; R 1994) Safety Glazing Materials
Used in Buildings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

Drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, shape and thickness of materials, and details of construction. A schedule showing the location, each sign type, and message shall be included.

SD-03 Product Data

Installation

Manufacturer's descriptive data, catalogs cuts, installation and cleaning instructions.

SD-04 Samples

Interior Signage

One sample of each of the following sign types designated in structural interior design (SID) submission showing typical quality and workmanship. The samples may be installed in the work, provided each sample is identified and location recorded.

- a. Directional sign.
- b. Door identification sign.

Two samples of manufacturer's standard color chips for each material requiring color selection.

SD-10 Operation and Maintenance Data

Approved Manufacturer's Instructions
Protection and Cleaning

Six copies of operating instructions outlining the step-by-step procedures required for system operation shall be provided. The instructions shall include simplified diagrams for the system as installed. Six copies of maintenance instructions listing routine procedures, repairs, and guides shall be provided. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS", name and location of the facility, name of the Contractor, and contract number.

1.3 GENERAL

Interior signage shall be of the design, detail, sizes, types, and message content shown in the SID submission, shall conform to the requirements specified, and shall be provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation.

1.3.1 Character Proportions and Heights

Letters and numbers on indicated signs in handicapped-accessible buildings, which do not designate permanent rooms or spaces, shall have a width-to-height ratio between 3:5 and 1:1 and a stroke-width-to-height ratio between 1:5 and 1:10. Characters and numbers on indicated signs shall be sized according to the viewing distance from which they are to be read. The minimum height is measured using an upper case letter "X". Lower case characters are permitted. Suspended or projected overhead signs shall have a minimum character height of 75 mm .

1.4 QUALIFICATIONS

Signs shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening.

1.5 DELIVERY AND STORAGE

Materials shall be delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area in accordance with manufacturer's instructions.

1.6 EXTRA STOCK

The Contractor shall provide extra stock of the following: 3 blank plates of each color and size for sign types AA3, BB5, CC2 and DD1.

PART 2 PRODUCTS

2.1 ROOM IDENTIFICATION/DIRECTIONAL SIGNAGE SYSTEM

Signs shall be fabricated of acrylic plastic conforming to ANSI Z97.1.

2.1.1 Standard Room Signs

Signs shall consist of gloss finish acrylic plastic. Units shall be frameless. Corners of signs shall be squared.

2.1.2 Changeable Message Strip Signs

Changeable message strip signs shall consist of cast acrylic with magnetic back, as detailed. Individual message strips to permit removal, change, and reinsertion shall be provided as detailed. Applicable for sign type BB5 (removable insert "day sleeper").

2.1.3 Type of Mounting For Signs

Extruded aluminum brackets, mounted as shown, shall be furnished for hanging, projecting, and double-sided signs. Mounting for framed, hanging, and projecting signs shall be by mechanical fasteners.

2.1.4 Graphics

Signage graphics for modular identification/directional signs shall conform to the following:

Message shall be applied to panel using the silkscreen process. Silkscreened images shall be executed with photo screens prepared from original art. Handcut screens will not be accepted. Original art shall be defined as artwork that is a first generation reproduction of the specified art. Edges and corners shall be clean.

2.2 ORGANIC COATING

Organic coating shall conform to AAMA 605, with total dry film thickness not less than 0.030 mm.

2.3 FABRICATION AND MANUFACTURE

2.3.1 Factory Workmanship

Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable.

2.3.2 Dissimilar Materials

Where dissimilar metals are in contact, the surfaces will be protected to prevent galvanic or corrosive action.

2.4 COLOR, FINISH, AND CONTRAST

Color shall be in accordance with 2.6 Interior Signage PD.S of SID submission. In buildings required to be handicapped-accessible, the characters and background of signs shall be eggshell, matte, or other non-glare finish. Characters and symbols shall contrast with their background - either light characters on a dark background or dark characters on a light background.

2.5 PRESSURE SENSITIVE LETTERS

2.5.1 Typeface

Helvetica medium.

2.5.2 Size

As indicated.

2.5.3 Color

As indicated.

PART 3 EXECUTION

3.1 INSTALLATION

Signs shall be installed in accordance with approved manufacturer's instructions at locations shown on the detail drawings. Signs shall be installed plumb and true at mounting heights indicated, and by method shown or specified. Required blocking shall be installed as detailed. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting location for such signage shall be so that a person may approach within 75 mm of signage without encountering protruding objects or standing within

the swing of a door. Signs on doors or other surfaces shall not be installed until finishes on such surfaces have been installed. Signs installed on glass surfaces shall be installed with matching blank back-up plates in accordance with manufacturer's instructions.

3.1.1 Anchorage

Anchorage shall be in accordance with approved manufacturer's instructions.

Anchorage not otherwise specified or shown shall include toggle bolts for dry-wall/stud application. Exposed anchor and fastener materials shall be compatible with metal to which applied and shall have matching color and finish. Where recommended by signage manufacturer, foam tape pads may be used for anchorage. Foam tape pads shall be minimum 2 mm thick closed cell vinyl foam with adhesive backing. Adhesive shall be transparent, long aging, high tech formulation on two sides of the vinyl foam. Adhesive surfaces shall be protected with a 0.13 mm green flatstock treated with silicone. Foam pads shall be sized for the signage as per signage manufacturer's recommendations. Signs mounted to painted gypsum board surfaces shall be removable for painting maintenance. Signs mounted to lay-in ceiling grids shall be mounted with clip connections to ceiling tees.

3.1.2 Protection and Cleaning

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Glass, frames, and other sign surfaces shall be cleaned in accordance with the manufacturer's approved instructions.

-- End of Section --

SECTION 10500

LOCKERS
09/99

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Types; G

Location; G

Installation

Numbering system

SD-03 Product Data

Material

Finish

Locker components

Assembly instructions

SD-04 Samples

Color chips; G

1.2 DELIVERY, HANDLING, AND STORAGE

Deliver lockers and associated materials in their original packages, containers, or bundles bearing the manufacturer's name and the name of the material. Protect from weather, soil, and damage during delivery, storage, and construction.

1.3 FIELD MEASUREMENTS

To ensure proper fits, make field measurements prior to the preparation of drawings and fabrication.

1.4 QUALITY ASSURANCE

1.4.1 Color Chips

Provide a minimum of three color chips, not less than 75 mm square, of each color scheduled.

PART 2 PRODUCTS

2.1 TYPES

Provide single-tier lockers in the location, quantities and size indicated.
Provide locker finish color as scheduled.

2.2 MATERIAL

2.2.1 Solid Phenolic Composite Panels

Phenolic panels are composed of decorative papers impregnated with melamine resin with a clear protective overcoat. This covering is integrally compression molded with a core consisting of solid phenolic impregnated kraft papers.

2.2.2 Finish

Rough matte finish.

2.2.2.1 Color

As scheduled. Refer to Section 09915, Color Schedule.

2.3 COMPONENTS

2.3.1 Built-In Locks

Provide built-in combination locks with master key.

2.3.2 Interior Hooks

Shall be gray nylon colored throughout.

2.3.3 Doors

Shall be made from 1/2 inch (13 mm) thick material as above and shall be with radius corners and polished edges. Colors and patterns shall be selected from panel manufacturer's standards.

2.3.3.1 Hinges

Shall be constructed from 304-grade stainless steel. Quantity shall be three for full height doors and two for multi-tier units. Hinges shall be secured by bolts through the door OR tapped into the doors as an option.

2.3.3.2 Retaining Bar

Provide stainless steel limit arm opening no more than 90 degrees.

2.3.4 Panel Material

Decorative papers impregnated with melamine resin on faces with a clear protective overcoat and integrally compression molded with a core consisting of solid phenolic impregnated kraft papers.

2.3.4.1 Back and Side Panels, Tops, Bottoms, and Intermediate Shelving

Tops, bottoms, and any intermediate shelves for multi-tier lockers shall be 1/2 inch (13 mm) thick material as above and have ventilation holes. Locker backs shall be 1/4 inch (6 mm) thick as above and side panels shall be 3/8 inch (10 mm) thick as above. Fasteners shall be applied directly into or through the material. Aluminum or metal profiles for reinforcements shall not be permitted.

2.3.4.2 Ancillary Panels

Finished end panels and closures shall be 1/2 inch (13 mm) thick as above. Sloping tops, if any, shall be 1/4 inch (6 mm) thick as above.

2.3.5 Base

Curb mounted: curb/base by others.

2.3.6 Number Plates

Identification plates to be black background with white fonts and surface mounted with permanent adhesive integral with the locking mechanism. Fonts to be 5/8 inches high and up to four alphanumeric characters. Numbering sequence to be provided by architect.

2.3.7 Fastening Devices

Exposed fasteners shall be 304 stainless steel.

2.4 VENTILATION

2.4.1 Standard

Provide six 3/8 inch (10 mm) diameter ventilation holes on tops, bottoms, and intermediary shelves. Provide three 3/8 inch (10 mm) diameter ventilation holes on "Z" type intermediary shelves.

2.4.2 Optional

Provide minimum of 20 square inches opening of front ventilation for full tier 12 inch wide x 72 inch high. For other styles, provide front ventilation 1.43 square inches per lineal feet of door perimeter.

PART 3 EXECUTION

3.1 ASSEMBLY AND INSTALLATION

Assemble lockers according to the locker manufacturer's instructions. Align lockers horizontally and vertically. Secure lockers to wall and base with screws as indicated. Bolt adjacent lockers together. Adjust doors to operate freely without sticking or binding and to ensure they close tightly.

3.2 NUMBERING SYSTEM

Install number plates on lockers consecutively as indicated.

3.3 FIELD QUALITY CONTROL

3.3.1 Testing

Government may request performance-characteristic tests on assembled lockers.

3.3.2 Repairing

Remove and replace damaged and unacceptable portions of completed work with new.

3.3.3 Cleaning

Clean surfaces of the work, and adjacent surfaces soiled as a result of the work, in an approved manner. Remove equipment, surplus materials, and rubbish from the site.

-- End of Section --

SECTION 10800

TOILET ACCESSORIES

07/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 1036 (2001) Flat Glass

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Finishes
Accessory Items

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, operation instructions, and cleaning instructions.

SD-04 Samples

Finishes
Accessory Items

One sample of each accessory proposed for use. Approved samples may be incorporated into the finished work, provided they are identified and their locations noted.

SD-07 Certificates

Accessory Items

Submit for each type of accessory specified, attesting that the items meet the specified requirements.

SD-10 Operation and Maintenance Data

Electric Hand Dryer

Four complete copies of maintenance instructions listing routine maintenance procedures and possible breakdowns and repairs. Instructions shall include simplified wiring and control diagrams and other information necessary for unit maintenance.

1.3 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area protected from construction damage and vandalism.

1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Toilet accessories shall be provided where indicated in accordance with paragraph SCHEDULE. Porcelain type, tile-wall accessories are specified in Section 09310 CERAMIC TILE QUARRY TILE, AND PAVER TILE. Each accessory item shall be complete with the necessary mounting plates and shall be of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be suited for use with the supporting construction. Exposed fasteners shall have oval heads and shall be finished to match the accessory.

2.1.2 Finishes

Except where noted otherwise, finishes on metal shall be provided as follows:

Metal	Finish
_____	_____
Stainless steel	No. 4 satin finish
	Chromium plated, bright

2.2 ACCESSORY ITEMS

Accessory items shall conform to the requirements specified below.

2.2.1 Grab Bar (GB)

Grab bar shall be 18 gauge, 32 mm OD Type 304 stainless steel. Grab bar shall be form and length as indicated. Exposed mounting flange shall have mounting holes concealed. Grab bar shall have satin finish peened non-slip surface. Installed bars shall be capable of withstanding a 2.225 kN vertical load without coming loose from the fastenings and without obvious permanent deformation. Space between wall and grab bar shall be 38 mm.

2.2.2 Medicine Cabinet (MC)

Medicine cabinet shall be constructed with cold-rolled carbon steel sheet of not less than 0.76 mm thick, formed from a single sheet of steel or shall have mechanically formed spot welded or any other suitable joints. Width, height and depth of cabinet shall be in accordance with paragraph SCHEDULE.

2.2.3 Mirrors, Glass (MG)

Glass for mirrors shall be Type I transparent flat type, Class 1-clear. Glazing Quality q1 6 mm thick conforming to ASTM C 1036. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 6 mm thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.2.4 Combination Paper Towel Dispenser/Waste Receptacle Units (PTDWR)

Dispenser/receptacle shall be recessed and shall have a capacity of 400 sheets of C-fold, single-fold, or quarter-fold towel. Waste receptacle shall be designed to be locked in unit and removable for service. Locking mechanism shall be tumbler key lock. Waste receptacle shall have a capacity of 45 L. Unit shall be fabricated of not less than 0.8 mm stainless steel welded construction with all exposed surfaces having a satin finish. Waste receptacle that accepts reusable liner standard for unit manufacturer shall be provided.

2.2.5 Shower Curtain (SC)

Shower curtain shall be textile, size to suit conditions. Curtain shall be anti-bacterial vinyl fabric. Color shall be as shown in Section 09915 COLOR SCHEDULE.

2.2.6 Shower Curtain Rods (SCR)

Shower curtain rods shall be Type 304 stainless steel 32 mm OD by 1.24 mm minimum straight to meet installation conditions.

2.2.7 Soap Dispenser (SD)

Soap dispenser shall be surface mounted, liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 1.2 L with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps.

2.2.8 Soap Holder (SH)

Soap holder shall be surface mounted Type 304 stainless steel. Separate supports shall be stainless steel.

2.2.9 Towel Bar (TB)

Towel bar shall be stainless steel with a minimum thickness of 0.38 mm. Bar shall be minimum 19 mm diameter, or 16 mm square. Finish shall be satin.

2.2.10 Toilet Tissue Dispenser (TTD)

Toilet tissue holder shall be Type III - recess mounted with one roll of standard tissue.

2.2.11 Toilet Tissue Dispenser (TTD)

Toilet tissue dispenser shall be Type III - recessed mounted with 2 rolls of standard tissue mounted horizontally. Cabinet shall be fabricated of stainless steel, satin finish.. Cover shall have key lock.

2.2.12 Hooks

As per construction documents.

2.2.13 Waste Paper Basket

As per CID package.

PART 3 EXECUTION

3.1 INSTALLATION

Surfaces of fastening devices exposed after installation shall have the same finish as the attached accessory. Exposed screw heads shall be oval. Install accessories at the location and height indicated. Protect exposed surfaces of accessories with strippable plastic or by other means until the installation is accepted. After acceptance of accessories, remove and dispose of strippable plastic protection. Coordinate accessory manufacturer's mounting details with other trades as their work progresses. Brackets, plates, anchoring devices and similar items used for mounting accessories in showers shall be bedded in a silicone or polysulphide sealant as they are set to provide a watertight installation. After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

3.1.1 Recessed Accessories

Fasten accessories with wood screws to studs, blocking or rough frame in wood construction. Set anchors in mortar in masonry construction. Fasten to metal studs or framing with sheet metal screws in metal construction.

3.1.2 Surface Mounted Accessories

Mount on concealed backplates, unless specified otherwise. Accessories without backplates shall have concealed fasteners. Unless indicated or specified otherwise, install accessories with sheet metal screws or wood screws in lead-lined braided jute, teflon or neoprene sleeves, or lead expansion shields, or with toggle bolts or other approved fasteners as required by the construction. Install backplates in the same manner, or provide with lugs or anchors set in mortar, as required by the construction. Fasten accessories mounted on gypsum board and plaster walls without solid backing into the metal or wood studs or to solid wood blocking secured between wood studs, or to metal backplates secured to metal studs.

3.2 CLEANING

Material shall be cleaned in accordance with manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring of surfaces.

3.3 SCHEDULE

Refer to construction documents.

-- End of Section --

SECTION 11401N

ELECTRIC KITCHEN EQUIPMENT

08/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

NSF INTERNATIONAL (NSF)

NSF 2 (2002) Food Equipment

UNDERWRITERS LABORATORIES (UL)

UL 250 (1993; Rev thru Aug 2000) Household Refrigerators and Freezers

UL 430 (1994; Rev thru Mar 2001) Waste Disposers

UL 858 (1993; Rev thru Sep 2001) Household Electric Ranges

UL 921 (1996; Rev thru Mar 2000) Commercial Electric Dishwashers

UL 923 (2002; Rev thru Jan 2003) Microwave Cooking Appliances

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Kitchen equipment

SD-08 Manufacturer's Instructions

Kitchen equipment

Exhaust hood

SD-10 Operation and Maintenance Data

Kitchen equipment, Data Package 2; G

Submit operation and maintenance data in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

PART 2 PRODUCTS

2.1 KITCHEN EQUIPMENT

2.1.1 Materials

Except as modified herein, provide manufacturer's standard materials for kitchen equipment. Provide quantities, physical dimensions, colors, and electrical characteristics as indicated.

2.1.2 Microwave Oven

UL 923, built-in, with black glass window door, minimum 28 liter capacity, automatic oven light, browning element, 10 power levels, automatic temperature controllers, minimum two automatic memory levels, digital time controllers, and electronic touch-control panel. Microwave oven will be located over range. The unit will be vented, with two-speed fan, permanent washable filter, rear exhaust, and eye level controls.

2.1.3 KITCHEN UNIT

NSF 2, UL 250, and UL 858 consisting of refrigerator, range and oven, wall cabinets, and sink and countertop.

2.1.3.1 Refrigerator

Refrigerator assembly with freezer, corrosion-resistant inner lining, and minimum net capacity of .52 cubic meters. Provide minimum one ice cube tray, removable shelves, automatic interior light, adjustable cold controls, and automatic defrost.

2.1.3.2 Range and Oven

Tubular plug-in surface elements of minimum 4,500 total watts at 208 volts, infinite control switches, and range indicating "on" lights. Equip oven with one minimum 2,000-watt tubular broil element and one minimum 700-watt tubular bake element, oven indicating light, automatic oven-heat control, and utensil drawer.

2.1.3.3 Sink and Countertop

One-piece, seamless, double-bowl, 200 deep, under mounted minimum 0.9 mm thick stainless steel sink. Provide drainboard, swing spout faucet with aerator, 90 mm drain, and continuous feed garbage disposer with minimum 1.2

liter capacity conforming to paragraph entitled "Garbage Disposal" in this section.

2.1.3.4 Wall Cabinets

Refer to Section 12320A - Residential Cabinets and Countertops.

2.1.4 DISHWASHER

UL 921, with detergent dispenser. Provide automatic control to cycle machine through wash, rinse, dry or heat, and stop phases. Include manual setting to repeat or skip phases of cycle. Equip machine with safety switch which automatically stops spraying action when door is open. For medium duty dishwasher, provide household grade, with minimum 500-watt input for drying dishes.

2.1.5 HOUSEHOLD GARBAGE DISPOSAL

UL 430, stainless steel continuous feed model, 375 watt motor, and stainless steel grinding element with two 360 degree stainless steel swivel impellers. Provide polyethylene or polyester drain flow chamber. Equip motor with manual reset, thermal overload protection, and sound insulation.

PART 3 EXECUTION

3.1 INSTALLATION

NFPA 70, Section 15400N PLUMBING SYSTEMS, and Section 16402N INTERIOR DISTRIBUTION SYSTEM. Install kitchen equipment in accordance with manufacturers' instructions.

3.2 FIELD QUALITY CONTROL

Conduct inspection and testing in the presence of the Contracting Officer.

3.2.1 Field Inspection

Before and after installation, inspect each piece of kitchen equipment for compliance with specified requirements.

3.2.2 Operation Tests

Upon completion, but before final acceptance, perform operation tests on each piece of equipment to determine that components, including controls, safety devices, and attachments, operate properly and in accordance with specified requirements.

-- End of Section --

SECTION 12320A

RESIDENTIAL CABINETS AND COUNTERTOPS

03/04

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.9 (2003) Cabinet Hardware

KITCHEN CABINET MANUFACTURERS ASSOCIATION (KCMA)

KCMA A161.1 (2000) Performance & Construction
Standards for Kitchen and Vanity Cabinets

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3 (2000) High-Pressure Decorative Laminates

1.2 DESIGN

Cabinets shall be wood, factory-fabricated and finished in the manufacturer's standard sizes and finishes of the type, design, and configuration indicated. Cabinets shall be constructed as specified and shall meet the requirements of KCMA A161.1. Wall and base cabinet assemblies shall consist of individual units joined into continuous sections. Fastenings shall be accomplished to permit removal and replacement of individual units without affecting the remainder of the installation. Counters shall be provided with watertight sink rim when indicated. Drawers shall be removable and shall be equipped with position stops to avoid accidental complete withdrawals. Shelves shall be fixed or adjustable as indicated.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G, AE

Drawings showing each type of cabinet and related item, and clearly indicating the complete plan, location, and elevations of the cabinets and accessories and pertinent details of construction, fabrication, and attachments.

SD-03 Product Data

Cabinets
Countertops and Backsplash

Manufacturer's printed data, catalog cuts, installation and cleaning instructions.

SD-04 Samples

Cabinets; G
Countertops and Backsplash; G

In lieu of individual samples, complete minimum size cabinets may be furnished as samples. Mock-up units are not acceptable. Samples shall be of sufficient size to show color, pattern, and method of assembly.

- a. Countertop and backsplash - One section, containing both.
- b. Door and drawer front - One of each, with hardware mounted.
- c. Three countertop color samples approximately 50 x 75 mm size.
- d. Three cabinet stain/color samples approximately 50 x 75 mm size.

SD-06 Test Reports

Cabinets

Test reports certifying that all cabinets comply with the requirements of KCMA A161.1. Tests shall be conducted by independent laboratories approved by KCMA. KCMA certification seals affixed to the cabinets will be accepted in lieu of certified test reports.

1.4 DELIVERY AND STORAGE

Cabinets shall be delivered to the jobsite wrapped in a protective covering. Cabinets shall be stored in accordance with manufacturer's recommendations in an adequately ventilated, dry location that is free of dust, water, or other contaminants and in a manner to permit access for inspection and handling. Cabinets shall be handled carefully to prevent damage to the surfaces. Damaged items that cannot be restored to like-new condition shall be replaced.

PART 2 PRODUCTS

2.1 CABINETS

Wall and base cabinets shall be of the same construction and same outside appearance. Door design shall be framed inset hardwood panels from vendors standard styles. Corner cabinets shall be equipped with notched shelving as indicated. Shelves shall be fixed or fully adjustable as indicated. Adjustable shelves shall be capable of adjusting on approximately 75 mm increments. Shelves shall be supported by self-locking clips or wood dowels. Dowels shall be approximately 8 mm in diameter by 40 mm long. Dowels shall be inserted into borings for the shelf adjustments. Shelves shall be minimum 13 mm thick plywood or minimum 13 mm thick 20 kg density particle board. Drawer fronts shall be in accordance with the CID package under a separate cover.

2.1.1 Frame Type Cabinets

The cabinets shall be constructed with frame fronts and solid ends, or frame construction throughout. Frame members shall be 19 mm thick by 38 mm wide; kiln-dried hardwood, glued together, and shall be either mortised and tenoned, dovetailed or doweled, nailed, stapled or screwed. Top and bottom corners shall be braced with either hardwood blocks that are glued together with water resistant glue and nailed in place, or metal or plastic corner braces. Backs of wall cabinets shall be 3 mm thick plywood, tempered hardboard or 9 mm thick, 20 kg density particle board. Backs of base and tall cabinets shall be 9 mm thick hardwood or 9 mm thick, 20 kg density particle board. Bottoms of cabinets shall be minimum 9 mm thick plywood 20 kg density particle board or good grade plywood and shall be braced with wood members glued in place. Cabinet ends shall be 16 mm thick hardwood plywood.

2.1.2 Frameless Type Cabinets

The cabinets shall be of frameless design and construction. Cabinets shall be constructed of minimum 16 mm thick, 20 kg density particle board end and floor panels. Cabinet back shall be constructed of minimum 5 mm thick, 20 kg density particle board. Hanging rails shall be doweled and glued to end panels, then fastened and hot melt glued to cabinet back. Toe kick plates shall be recessed, doweled and glued to the end panels. Top and bottom corners shall be braced with either hardwood blocks glued together with water resistant glue and nailed in place, or fastened with metal or plastic corner braces.

2.2 COUNTERTOPS AND BACKSPLASH

2.2.1 Solid Polymer Countertops

Refer to Section 06650 - Solid Polymer (Solid Surface) Fabrication.

2.3 Sink/Lavatory Rims

Sink/lavatory rims shall be of the corrosion resistant stainless steel undermounted sink, and a standard product of a manufacturer regularly

producing this type of equipment. Sink must be installed according to manufacturer's recommendations.

2.4 FINISH

2.4.1 Cabinet Finish

Cabinets shall be provided with a factory-applied durable finish in accordance with KCMA A161.1 requirements and of a type standard with the manufacturer. Natural finish wood doors, drawer fronts, cabinet fronts, and exposed cabinet sides shall be fabricated of wood which will be free of extreme color variations within each panel or between adjacent panels. Exposed exterior surfaces shall be hardwood or grade A-A hardwood veneer with natural stain and sprayed on factory applied finish.

2.4.2 Melamine Laminated Interior Cabinet Finish

Plywood, particle board or tempered hardboard cabinet backs shall be finished with a melamine laminate on the exposed side. Particle board shelves shall be covered on both sides with a laminated melamine finish. Melamine laminate shall conform to the requirements of NEMA LD 3 and laminate adhesive shall be contact type applied to both surfaces.

2.4.3 Backer Sheets

Backer Sheets of high pressure plastic laminate, shall conform to NEMA LD 3, Grade BK20 and shall be applied to the underside of all core material.

2.5 HARDWARE

Hardware shall conform to BHMA A156.9, shall be suitable for kitchen cabinet use, and shall include all miscellaneous hardware for a complete installation. Door hinges shall be self-closing type. Drawer runners shall have nylon rollers standard with the manufacturer. Hardware and fastenings for doors and drawers with particle board cores shall be of the through-bolt type. The types and finishes of hardware shall be as follows:

BHMA DESIGNATION

TYPE	NUMBER	FINISH
[_____]	[_____]	[_____]

2.6 COLOR, TEXTURE, AND PATTERN

Color shall be in accordance with Section 09915 COLOR SCHEDULE. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 INSTALLATION

Cabinets shall be installed level, plumb, and true to line, and shall be

attached to the walls or floors with suitable devices to securely anchor each unit. Countertops, accessories, and hardware shall be installed as indicated on the drawings. Installation shall be in accordance with the manufacturer's approved printed instructions. The inner edge of sink cut-outs in laminated plastic tops shall be painted with a coat of semigloss enamel paint and sink flanges shall be set in a bed of sealant. Closer and filler strips and finish moldings shall be provided as required.

Prior to final acceptance, doors shall be aligned, and hardware shall be adjusted.

3.2 CLEANING

Cabinet and countertop surfaces shall be cleaned in accordance with manufacturer's instructions.

-- End of Section --

SECTION 12490A

WINDOW TREATMENT

12/03

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings; G

Drawings showing fabrication and installation details. Drawings shall show layout and locations of track, direction of draw, mounting heights, and details.

SD-03 Product Data

Window Treatments
Hardware

Manufacturer's data composed of catalog cuts, brochures, product information, and maintenance instructions.

SD-04 Samples

Window Treatments

Three samples of each type and color of window treatment. Blind slats or louvers shall be 150 mm in length for each color. Track shall be 150 mm in length. Shade material shall be minimum 150 x 150 mm in size.

1.2 GENERAL REQUIREMENTS

Window treatment shall be provided, complete with necessary brackets, fittings, and hardware. Each window treatment type shall be a complete unit provided in accordance with paragraph WINDOW TREATMENT PLACEMENT SCHEDULE. Equipment shall be mounted and operated as indicated. Windows to receive a treatment shall be completely covered. The Contractor shall take measurements at the building and shall be responsible for the proper fitting and hanging of the equipment.

1.3 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately ventilated and free from dust, water, or other contaminants and shall have easy access for inspection and handling. Materials shall be stored flat in a clean dry area with temperature maintained above 10 degrees C .

1.4 FIELD MEASUREMENTS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 WINDOW SHADES

2.1.1 Room Darkening Shades

Room darkening (black-out) window shades shall conform to the following: Roller tube shall be aluminum. Light traps shall be shop fabricated, and shall consist of a head box to house the shade roller, and U-shaped channels to serve as guides for the shade along the sides and to receive the bottom edge of the shade along the sill. Light trap shall be made of sheet steel having a minimum thickness of 0.85 mm or anodized, extruded, aluminum. The legs of the channels shall be not less than 44 mm long and separated by the minimum distance that will permit free operation of the shade. Edges of light trap coming into contact with the shade cloth shall be smooth pile light seal. The exposed face of the head box shall be hinged or removable for access to the shade roller. The interior or unexposed surfaces of the light trap shall have a finish coat of flat black enamel. The exposed portions of the light trap shall have a factory-applied priming coat of gray paint. Shade roller shall be manufacturer's standard product. Cloth shall be of type for blackout purposes. The shade shall be made from a single piece. When not finished with a selvage, the vertical edges of the shade shall be bound or hemmed using a high-grade thread. Needle holes shall be made lightproof by applying a suitable filler. The bottom edge of the shade shall be fitted with a steel operating bar. Shades will engage positively with bottom rail through operating bar or chain pull. Bars shall be painted with flat black enamel. Pull cords shall be made of No. 4 braided nylon or beaded chain having not less than 335 N breaking strength. Please note the specifications from manufacturer.

2.2 COLOR

Color shall be in accordance with Section 09915 COLOR SCHEDULE. To be in white textile on both sides.

PART 3 EXECUTION

3.1 WINDOW TREATMENT PLACEMENT SCHEDULE

Window covering shall be provided as follows:

Room Number/Name	Window Covering Type	Drapery Draw Type/Direction	Window Type
All windows	FABER	Type FABER 1800	Plastic

Please note document A-35.

3.2 INSTALLATION

Installation shall be in accordance with the approved detail drawings and manufacturer's installation instructions. Units shall be level, plumb, secure, and at proper height and location relative to window units. The Contractor shall furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Installation shall not be initiated until completion of room painting and finishing operations. Upon completion of the installation, window treatments shall be adjusted for form and appearance, shall be in proper operating condition, and shall be free from damage or blemishes. Damaged units shall be repaired or replaced by the Contractor as directed by the Contracting Officer.

-- End of Section --

SECTION 13100A

LIGHTNING PROTECTION SYSTEM

07/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C135.30 (1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

NFPA 780 (1997) Installation of Lightning Protection Systems

UNDERWRITERS LABORATORIES (UL)

UL 96 (1994; Rev thru Jan 2000) Lightning Protection Components

UL 96A (1994; Rev thr Jul 1998) Installation Requirements for Lightning Protection Systems

UL 467 (1993; Rev thru Apr 1999) Grounding and Bonding Equipment

UL Elec Const Dir (1999) Electrical Construction EquipmentDirectory

1.2 GENERAL REQUIREMENTS

1.2.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work. No departures shall be made without the prior approval of the Contracting Officer.

1.2.2 System Requirements

The system furnished under this specification shall consist of the standard

products of a manufacturer regularly engaged in the production of lightning protection systems and shall be the manufacturer's latest UL approved design. The lightning protection system shall conform to NFPA 70 and NFPA 780, UL 96 and UL 96A, except where requirements in excess thereof are specified herein. Installation shall be UL MASTER LABELLED.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings; G, AE

Detail drawings consisting of a complete list of material, including manufacturer's descriptive and technical literature, catalog cuts, drawings, and installation instructions. Detail drawings shall demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.

SD-07 Certificates

Materials; G, AE

Where material or equipment is specified to comply with requirements of UL, proof of such compliance. The label of or listing in UL Elec Const Dir will be acceptable evidence. In lieu of the label or listing, a written certificate from an approved nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of Underwriters Laboratories may be submitted.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 General Requirements

No combination of materials shall be used that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, conductors with protective coatings or oversize conductors shall be used. Where a mechanical hazard is involved, the conductor size shall be increased to compensate for the hazard or the conductors shall be protected by covering them with molding or tubing made of wood or nonmagnetic material. When metallic conduit or tubing is used, the conductor shall be electrically connected at the upper and lower ends.

2.1.2 Main and Secondary Conductors

Conductors shall be in accordance with NFPA 780 and UL 96 for Class I, Class II, or Class II modified materials as applicable.

2.1.2.1 Copper

Copper conductors used on nonmetallic stacks shall weigh not less than 170 kg per 300 m (375 pounds per thousand feet), and the size of any wire in the cable shall be not less than No. 15 AWG. The thickness of any web or ribbon used on stacks shall be not less than No. 12 AWG. Counterpoise shall be copper conductors not smaller than No. 1/0 AWG.

2.1.2.2 Aluminum

Aluminum shall not contact the earth nor shall it be used in any other manner that will contribute to rapid deterioration of the metal. Appropriate precautions shall be observed at connections with dissimilar metals. Aluminum conductors for bonding and interconnecting metallic bodies to the main cable shall be at least equivalent to strength and cross-sectional area of a No. 4 AWG aluminum wire. When perforated strips are provided, strips that are much wider than solid strips shall be. A strip width that is at least twice that of the diameter of the perforations shall be used. Aluminum strip for connecting exposed water pipes shall be not less than No. 12 AWG in thickness and at least 38.1 mm wide.

2.1.3 Air Terminals

Terminals shall be in accordance with UL 96 and NFPA 780. The tip of air terminals on buildings used for manufacturing, processing, handling, or storing explosives, ammunition, or explosive ingredients shall be a minimum of 600 mm above the ridge parapet, ventilator or perimeter. On open or hooded vents emitting explosive dusts or vapors under natural or forced draft, air terminals shall be a minimum of 1.5 m above the opening. On open stacks emitting explosive dusts, gases, or vapor under forced draft, air terminals shall extend a minimum of 4.5 m above vent opening. Air terminals more than 600 mm in length shall be supported by a suitable brace, with guides not less than one-half the height of the terminal.

2.1.4 Ground Rods

Rods made of copper-clad steel shall conform to UL 467 and galvanized ferrous rods shall conform to ANSI C135.30. Ground rods shall be not less than 19.1 mm (3/4 inch) in diameter and 3.048 m (10 feet) in length. Ground rods of copper-clad steel, stainless steel, galvanized ferrous, and solid copper shall not be mixed on the job.

2.1.5 Connectors

Clamp-type connectors for splicing conductors shall conform to UL 96, class as applicable, and, Class 2, style and size as required for the installation. Clamp-type connectors shall only be used for the connection of the roof conductor to the air terminal and to the guttering. All other

connections, bonds, and splices shall be done by exothermic welds or by high compression fittings. The exothermic welds and high compression fittings shall be listed for the purpose. The high compression fittings shall be the type which require a hydraulically operated mechanism to apply a minimum of 10,000 psi.

2.1.6 Lightning Protection Components

Lightning protection components, such as bonding plates, air terminal supports, chimney bands, clips, and fasteners shall conform to UL 96, classes as applicable.

PART 3 EXECUTION

3.1 INTEGRAL SYSTEM

3.1.1 General Requirements

The lightning protection system shall consist of air terminals, roof conductors, down conductors, ground connections, and grounds, electrically interconnected to form the shortest distance to ground. All conductors on the structures shall be exposed except where conductors are in protective sleeves exposed on the outside walls. Secondary conductors shall interconnect with grounded metallic parts within the building. Interconnections made within side-flash distances shall be at or above the level of the grounded metallic parts.

3.1.1.1 Air Terminals

Air terminal design and support shall be in accordance with NFPA 780. Terminals shall be rigidly connected to, and made electrically continuous with, roof conductors by means of pressure connectors or crimped joints of T-shaped malleable metal and connected to the air terminal by a dowel or threaded fitting. Air terminals at the ends of the structure shall be set not more than 600 mm (2 feet) from the ends of the ridge or edges and corners of roofs. Spacing of air terminals 600 mm (2 feet) in height on ridges, parapets, and around the perimeter of buildings with flat roofs shall not exceed 7.5 meters. In specific instances where it is necessary to exceed this spacing, the specified height of air terminals shall be increased not less than 50 mm for each 300 mm of increase over 7.5 meters. On large, flat or gently sloping roofs, as defined in NFPA 780, air terminals shall be placed at points of the intersection of imaginary lines dividing the surface into rectangles having sides not exceeding 15 m in length. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Metal projections and metal parts of buildings, smokestacks, and other metal objects that do not contain hazardous materials and that may be struck but not appreciably damaged by lightning, need not be provided with air terminals. However, these metal objects shall be bonded to the lightning conductor through a metal conductor of the same unit weight per length as the main conductor. Where metal ventilators are installed, air terminals shall be mounted thereon, where practicable. Any air terminal erected by necessity adjacent to a metal ventilator shall be

bonded to the ventilator near the top and bottom. Where metal ventilators are installed with air terminals mounted thereon, the air terminal shall not be more than 610 mm away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement. Where metal ventilators are installed with air terminals mounted adjacent, the air terminal shall not be more than 610 mm away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement.

3.1.1.2 Roof Conductors

Roof conductors shall be connected directly to the roof or ridge roll. Sharp bends or turns in conductors shall be avoided. Necessary turns shall have a radius of not less than 200 mm. Conductors shall preserve a downward or horizontal course and shall be rigidly fastened every 900 mm along the roof and down the building to ground. Metal ventilators shall be rigidly connected to the roof conductor at three places. All connections shall be electrically continuous. Roof conductors shall be coursed along the contours of flat roofs, ridges, parapets, and edges; and where necessary, over flat surfaces, in such a way as to join each air terminal to all the rest. Roof conductors surrounding tank tops, decks, flat surfaces, and flat roofs shall be connected to form a closed loop.

3.1.1.3 Down Conductors

Down conductors shall be electrically continuous from air terminals and roof conductors to grounding electrodes. Down conductors shall be coursed over extreme outer portions of the building, such as corners, with consideration given to the location of ground connections and air terminals. Each building or structure shall have not less than two down conductors located as widely separated as practicable, at diagonally opposite corners. On rectangular structures having gable, hip, or gambrel roofs more than 35 m long, there shall be at least one additional down conductor for each additional 15 m of length or fraction thereof. On rectangular structures having French, flat, or sawtooth roofs exceeding 75 m in perimeter, there shall be at least one additional down conductor for each 30 m of perimeter or fraction thereof. On an L- or T-shaped structure, there shall be at least one additional down conductor; on an H-shaped structure, at least two additional down conductors; and on a wing-built structure, at least one additional down conductor for each wing.

On irregularly shaped structures, the total number of down conductors shall be sufficient to make the average distance between them along the perimeter not greater than 30 meters. On structures exceeding 15 m in height, there shall be at least one additional down conductor for each additional 18 m of height or fraction thereof, except that this application shall not cause down conductors to be placed about the perimeter of the structure at intervals of less than 15 meters. Additional down conductors shall be installed when necessary to avoid "dead ends" or branch conductors ending at air terminals, except where the air terminal is on a roof below the main protected level and the "dead end" or branch conductor is less than 5 m in length and maintains a horizontal or downward coursing. Down conductors shall be equally and symmetrically spaced about the perimeter of the structure. Down conductors shall be protected by placing in rigid steel

conduit for a minimum distance of 1800 mm 72 inches above finished grade level. If the conduit is metal, the down conductor shall be bonded at the top and bottom of the conduit..

3.1.1.4 Interconnection of Metallic Parts

Metal doors, windows, and gutters shall be connected directly to the grounds or down conductors using not smaller than No. 6 copper conductor, or equivalent. Conductors placed where there is probability of unusual wear, mechanical injury, or corrosion shall be of greater electrical capacity than would normally be used, or shall be protected. The ground connection to metal doors and windows shall be by means of mechanical ties under pressure, or equivalent.

3.1.1.5 Ground Connections

Ground connections comprising continuations of down conductors from the structure to the grounding electrode shall securely connect the down conductor and ground in a manner to ensure electrical continuity between the two. All connections shall be of the clamp type. There shall be a ground connection for each down conductor. Metal water pipes and other large underground metallic objects shall be bonded together with all grounding mediums. Ground connections shall be protected from mechanical injury. In making ground connections, advantage shall be taken of all permanently moist places where practicable, although such places shall be avoided if the area is wet with waste water that contains chemical substances, especially those corrosive to metal.

3.1.1.6 Grounding Electrodes

A grounding electrode shall be provided for each down conductor located as shown. A driven ground shall extend into the earth for a distance of not less than 3.0 meters. Ground rods shall be set not less than 900 mm, nor more than 2.5 m, from the structures foundation. The complete installation shall have a total resistance to ground of not more than 5 ohms if a counterpoise is not used. Ground rods shall be tested individually prior to connection to the system and the system as a whole shall be tested not less than 24 hours after rainfall. When the resistance of the complete installation exceeds the specified value or two ground rods individually exceed 5 ohms, the Contracting Officer shall be notified immediately. A counterpoise, where required, shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 600 mm deep at a distance not less than 900 mm nor more than 2.5 m from the nearest point of the structure. All connections between ground connectors and grounds or counterpoise, and between counterpoise and grounds shall be electrically continuous. Where so indicated on the drawings, an alternate method for grounding electrodes in shallow soil shall be provided by digging trenches radially from the building. The lower ends of the down conductors or their equivalent in the form of metal strips or wires are then buried in the trenches.

3.1.2 Metal Roofs

Wood-Frame, Wall-Bearing Masonry or Tile Structure with Metallic Roof and Nonmetallic Exterior Walls, or Reinforced Concrete Building with Metallic Roof: Metal roofs which are in the form of sections insulated from each other shall be made electrically continuous by bonding. Air terminals shall be connected to, and made electrically continuous with, the metal roof as well as the roof conductors and down conductors. Ridge cables and roof conductors shall be bonded to the roof at the upper and lower edges of the roof and at intervals not to exceed 30 meters. The down conductors shall be bonded to roof conductors and to the lower edge of the metal roof.

Where the metal of the roof is in small sections, the air terminals and down conductors shall have connections made to at least four of the sections. All connections shall have electrical continuity and have a surface contact of at least 1935 square millimeters (3 square inches).

3.1.3 Metal Roofs With Metal Walls

Wood-Frame Building With Metal Roof and Metal Exterior Walls: The metal roof and the metal walls shall be bonded and made electrically continuous and considered as one unit. The air terminals shall be connected to and made electrically continuous with the metal roof as well as the roof and down conductors. All connections shall have electrical continuity and have a surface contact of at least 1935 square millimeters (3 square inches).

3.1.4 Steel Frame Building

The steel framework shall be made electrically continuous. Electrical continuity may be provided by bolting, riveting, or welding steel frame, unless a specific method is noted on the drawings. The air terminals shall be connected to the structural steel framework at the ridge. Short runs of conductors shall be used as necessary to join air terminals to the metal framework so that proper placing of air terminals is maintained. Separate down conductors from air terminals to ground connections are not required. Where a grounded metal pipe water system enters the building, the structural steel framework and the water system shall be connected at the point of entrance by a ground connector. Connections to pipes shall be by means of ground clamps with lugs. Connections to structural framework shall be by means of nut and bolt or welding. All connections between columns and ground connections shall be made at the bottom of the steel columns. Ground connections to grounding electrodes or counterpoise shall be run from not less than one-half of all the columns distributed equally around the perimeter of the structure at intervals averaging not more than 18 meters.

3.2 INSPECTION

The lightning protection system will be inspected by the Contracting Officer to determine conformance with the requirements of this specification. No part of the system shall be concealed until so authorized by the Contracting Officer.

-- End of Section --

SECTION 13280A

ASBESTOS ABATEMENT

11/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z87.1	(2003) Practice for Occupational and Educational Eye and Face Protection
ANSI Z88.2	(1992) Respiratory Protection
ANSI Z9.2	(2001) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

ASTM INTERNATIONAL (ASTM)

ASTM C 732	(2001) Aging Effects of Artificial Weathering on Latex Sealants
ASTM D 1331	(1989; R 2001) Surface and Interfacial Tension of Solutions of Surface-Active Agents
ASTM D 2794	(1993; R 1999e1) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 4397	(2002) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D 522	(1993a; R 2001) Mandrel Bend Test of Attached Organic Coatings
ASTM E 119	(2000a) Fire Tests of Building Construction and Materials
ASTM E 1368	(2002) Visual Inspection of Asbestos Abatement Projects
ASTM E 736	(2000) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to

Structural Members

ASTM E 84 (2003) Surface Burning Characteristics of Building Materials

ASTM E 96 (2000e1) Water Vapor Transmission of Materials

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-7 (2003) Compressed Air for Human Respiration

CGA G-7.1 (1997) Commodity Specification for Air

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH 84-100 (1984; 3rd Ed, R: 1994) NIOSH Manual of Analytical Methods

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (1996) Safety and Health Requirements Manual

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 340/1-90/018 (1990) Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance

EPA 340/1-90/019 (1990) Asbestos/NESHAP Adequately Wet Guidance

EPA 560/5-85-024 (1985) Guidance for Controlling Asbestos-Containing Materials in Buildings (Purple Book)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910 Occupational Safety and Health Standards

29 CFR 1926 Safety and Health Regulations for Construction

40 CFR 61 National Emission Standards for Hazardous Air Pollutants

40 CFR 763 Asbestos

42 CFR 84 Approval of Respiratory Protective Devices

49 CFR 107 Hazardous Materials Program Procedures

49 CFR 171 General Information, Regulations, and Definitions

49 CFR 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

49 CFR 173 Shippers - General Requirements for Shipments and Packagings

UNDERWRITERS LABORATORIES (UL)

UL 586 (1996; Rev thru Apr 2000) High-Efficiency, Particulate, Air Filter Units

THULE AB REGULATIONS

- 1) Standards Governing Environmental Protection for U.S. Installations in Greenland
- 2) Final Governing Standards (FGS), Chapter 15, Paragraph 15.4
- 3) Thule AB Lead Paint Operating and Management Plans

1.2 DEFINITIONS

- a. Adequately Wet: A term defined in 40 CFR 61, Subpart M, and EPA 340/1-90/019 meaning to sufficiently mix or penetrate with liquid to prevent the release of particulate. If visible emissions are observed coming from asbestos-containing material (ACM), then that material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wetted.
- b. Aggressive Method: Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact asbestos-containing material (ACM).
- c. Amended Water: Water containing a wetting agent or surfactant with a surface tension of at least 29 dynes per square centimeter when tested in accordance with ASTM D 1331.
- d. Asbestos: Asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated and/or altered.
- e. Asbestos-Containing Material (ACM): Any materials containing more than one percent asbestos.
- f. Asbestos Fiber: A particulate form of asbestos, 5 micrometers or longer, with a length-to-width ratio of at least 3 to 1.

- g. Authorized Person: Any person authorized by the Contractor and required by work duties to be present in the regulated areas.
- h. Building Inspector: Individual who inspects buildings for asbestos and has EPA Model Accreditation Plan (MAP) "Building Inspector" training; accreditation required by 40 CFR 763, Subpart E, Appendix C.
- i. Certified Industrial Hygienist (CIH): An Industrial Hygienist certified in the practice of industrial hygiene by the American Board of Industrial Hygiene.
- j. Class I Asbestos Work: Activities defined by OSHA involving the removal of thermal system insulation (TSI) and surfacing ACM.
- k. Class II Asbestos Work: Activities defined by OSHA involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos - containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic. Certain "incidental" roofing materials such as mastic, flashing and cements when they are still intact are excluded from Class II asbestos work. Removal of small amounts of these materials which would fit into a glovebag may be classified as a Class III job.
- l. Class III Asbestos Work: Activities defined by OSHA that involve repair and maintenance operations, where ACM, including TSI and surfacing ACM, is likely to be disturbed. Operations may include drilling, abrading, cutting a hole, cable pulling, crawling through tunnels or attics and spaces above the ceiling, where asbestos is actively disturbed or asbestos-containing debris is actively disturbed.
- m. Class IV Asbestos Work: Maintenance and custodial construction activities during which employees contact but do not disturb ACM and activities to clean-up dust, waste and debris resulting from Class I, II, and III activities. This may include dusting surfaces where ACM waste and debris and accompanying dust exists and cleaning up loose ACM debris from TSI or surfacing ACM following construction.
- n. Clean room: An uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.
- o. Competent Person: In addition to the definition in 29 CFR 1926, Section .32(f), a person who is capable of identifying existing asbestos hazards as defined in 29 CFR 1926, Section .1101, selecting the appropriate control strategy, has the authority to take prompt corrective measures to eliminate them and has EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training; accreditation required by 40 CFR 763, Subpart E, Appendix C.
- p. Contractor/Supervisor: Individual who supervises asbestos

abatement work and has EPA Model Accreditation Plan "Contractor/Supervisor" training; accreditation required by 40 CFR 763, Subpart E, Appendix C.

- q. Critical Barrier: One or more layers of plastic sealed over all openings into a regulated area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a regulated area from migrating to an adjacent area.
- r. Decontamination Area: An enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.
- s. Demolition: The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.
- t. Disposal Bag: A 0.15 mm thick, leak-tight plastic bag, pre-labeled in accordance with 29 CFR 1926, Section .1101, used for transporting asbestos waste from containment to disposal site.
- u. Disturbance: Activities that disrupt the matrix of ACM, crumble or pulverize ACM, or generate visible debris from ACM. Disturbance includes cutting away small amounts of ACM, no greater than the amount which can be contained in 1 standard sized glovebag or waste bag, not larger than 1.5 m in length and width in order to access a building component.
- v. Equipment Room or Area: An area adjacent to the regulated area used for the decontamination of employees and their equipment.
- w. Employee Exposure: That exposure to airborne asbestos that would occur if the employee were not using respiratory protective equipment.
- x. Fiber: A fibrous particulate, 5 micrometers or longer, with a length to width ratio of at least 3 to 1.
- y. Friable ACM: A term defined in 40 CFR 61, Subpart M and EPA 340/1-90/018 meaning any material which contains more than 1 percent asbestos, as determined using the method specified in 40 CFR 763, Subpart E, Appendix A, Section 1, Polarized Light Microscopy (PLM), that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. If the asbestos content is less than 10 percent, as determined by a method other than point counting by PLM, the asbestos content is verified by point counting using PLM.
- z. Glovebag: Not more than a 1.5 by 1.5 m impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which material and tools may be handled.

- aa. High-Efficiency Particulate Air (HEPA) Filter: A filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.
- bb. Homogeneous Area: An area of surfacing material or thermal system insulation that is uniform in color and texture.
- cc. Industrial Hygienist: A professional qualified by education, training, and experience to anticipate, recognize, evaluate, and develop controls for occupational health hazards.
- dd. Intact: ACM which has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix. Removal of "intact" asphaltic, resinous, cementitious products does not render the ACM non-intact simply by being separated into smaller pieces.
- ee. Model Accreditation Plan (MAP): USEPA training accreditation requirements for persons who work with asbestos as specified in 40 CFR 763, Subpart E, Appendix C.
- ff. Modification: A changed or altered procedure, material or component of a control system, which replaces a procedure, material or component of a required system.
- gg. Negative Exposure Assessment: A demonstration by the Contractor to show that employee exposure during an operation is expected to be consistently below the OSHA Permissible Exposure Limits (PELs).
- hh. NESHAP: National Emission Standards for Hazardous Air Pollutants. The USEPA NESHAP regulation for asbestos is at 40 CFR 61, Subpart M.
- ii. Nonfriable ACM: A NESHAP term defined in 40 CFR 61, Subpart M and EPA 340/1-90/018 meaning any material containing more than 1 percent asbestos, as determined using the method specified in 40 CFR 763, Subpart E, Appendix A, Section 1, Polarized Light Microscopy, that, when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.
- jj. Nonfriable ACM (Category I): A NESHAP term defined in 40 CFR 61, Subpart E and EPA 340/1-90/018 meaning asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos as determined using the method specified in 40 CFR 763, Subpart F, Appendix A, Section 1, Polarized Light Microscopy.
- kk. Nonfriable ACM (Category II): A NESHAP term defined in 40 CFR 61, Subpart E and EPA 340/1-90/018 meaning any material, excluding Category I nonfriable ACM, containing more than 1 percent asbestos, as determined using the methods specified in 40 CFR 763, Subpart F, Appendix A, Section 1, Polarized Light Microscopy, that when dry, cannot be crumbled, pulverized, or reduced to powder by

hand pressure.

11. Permissible Exposure Limits (PELs):

(1) PEL-Time weighted average(TWA): Concentration of asbestos not in excess of 0.1 fibers per cubic centimeter of air (f/cc) as an 8 hour time weighted average (TWA), as determined by the method prescribed in 29 CFR 1926, Section .1101, Appendix A, or the current version of NIOSH 84-100 analytical method 7400.

(2) PEL-Excursion Limit: An airborne concentration of asbestos not in excess of 1.0 f/cc of air as averaged over a sampling period of 30 minutes as determined by the method prescribed in 29 CFR 1926, Section .1101, Appendix A, or the current version of NIOSH 84-100 analytical method 7400.

mm. Regulated Area: An OSHA term defined in 29 CFR 1926, Section .1101 meaning an area established by the Contractor to demarcate areas where Class I, II, and III asbestos work is conducted; also any adjoining area where debris and waste from such asbestos work accumulate; and an area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed, the permissible exposure limit.

nn. Removal: All operations where ACM is taken out or stripped from structures or substrates, and includes demolition operations.

oo. Repair: Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM attached to structures or substrates. If the amount of asbestos so "disturbed" cannot be contained in 1 standard glovebag or waste bag, Class I precautions are required.

pp. Spills/Emergency Cleanups: Cleanup of sizable amounts of asbestos waste and debris which has occurred, for example, when water damage occurs in a building, and sizable amounts of ACM are dislodged. A Competent Person evaluates the site and ACM to be handled, and based on the type, condition and extent of the dislodged material, classifies the cleanup as Class I, II, or III. Only if the material was intact and the cleanup involves mere contact of ACM, rather than disturbance, could there be a Class IV classification.

qq. Surfacing ACM: Asbestos-containing material which contains more than 1% asbestos and is sprayed-on, troweled-on, or otherwise applied to surfaces, such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, or other purposes.

rr. Thermal system insulation (TSI) ACM: ACM which contains more than 1% asbestos and is applied to pipes, fittings, boilers, breeching, tanks, ducts, or other interior structural components to prevent heat loss or gain or water condensation.

ss. Transite: A generic name for asbestos cement wallboard and pipe.

tt. Worker: Individual (not designated as the Competent Person or a supervisor) who performs asbestos work and has completed asbestos worker training required by 29 CFR 1926, Section .1101, to include EPA Model Accreditation Plan (MAP) "Worker" training; accreditation required by 40 CFR 763, Subpart E, Appendix C, if required by the OSHA Class of work to be performed or by the state where the work is to be performed.

1.3 DESCRIPTION OF WORK

The work covered by this section includes the removal of asbestos-containing materials (ACM) which are encountered during demolition activities associated with this project and describes procedures and equipment required to protect workers and occupants of the regulated area from contact with airborne asbestos fibers and ACM dust and debris. Activities include OSHA Class I and Class II work operations involving ACM. The work also includes containment, storage, transportation and disposal of the generated ACM wastes. More specific operational procedures shall be detailed in the required Accident Prevention Plan and its subcomponents, the Asbestos Hazard Abatement Plan and Activity Hazard Analyses required in paragraph SAFETY AND HEALTH PROGRAM AND PLANS.

1.3.1 Abatement Work Tasks

The specific ACM to be abated is identified on the detailed plans and project drawings. A summary of work task data elements for each individual ACM abatement work task to include the appropriate RESPONSE ACTION DETAIL SHEET (item to be abated and methods to be used) and SET-UP DETAIL SHEETS (containment techniques to include safety precautions and methods) is included in Table 1, "Individual Work Task Data Elements" at the end of this section.

1.3.2 Unexpected Discovery of Asbestos

For any previously untested building components suspected to contain asbestos and located in areas impacted by the work, the Contractor shall notify the Contracting Officer (CO) who will have the option of ordering up to 3 bulk samples to be obtained at the Contractor's expense and delivered to a laboratory accredited under the National Institute of Standards and Technology (NIST) "National Voluntary Laboratory Accreditation Program (NVLAP)" and analyzed by PLM at no additional cost to the Government. Any additional components identified as ACM that have been approved by the Contracting Officer for removal shall be removed by the Contractor and will be paid for by an equitable adjustment to the contract price under the CONTRACT CLAUSE titled "changes". Sampling activities undertaken to determine the presence of additional ACM shall be conducted by personnel who have successfully completed the EPA Model Accreditation Plan (MAP) "Building Inspector" training course required by 40 CFR 763, Subpart E, Appendix C.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Respiratory Protection Program; G

Records of the respirator program.

Cleanup and Disposal; G

Waste shipment records. Weigh bills and delivery tickets shall be furnished for information only.

Detailed Drawings; G

Descriptions, detail project drawings, and site layout to include worksite containment area techniques as prescribed on applicable SET-UP DETAIL SHEETS, local exhaust ventilation system locations, decontamination units and load-out units, other temporary waste storage facility, access tunnels, location of temporary utilities (electrical, water, sewer) and boundaries of each regulated area.

Materials and Equipment

Manufacturer's catalog data for all materials and equipment to be used in the work, including brand name, model, capacity, performance characteristics and any other pertinent information. Test results and certificates from the manufacturer of encapsulants substantiating compliance with performance requirements of this specification. Material Safety Data Sheets for all chemicals to be used onsite in the same format as implemented in the Contractor's HAZARD COMMUNICATION PROGRAM. Data shall include, but shall not be limited to, the following items:

- a. High Efficiency Filtered Air (HEPA) local exhaust equipment
- b. Vacuum cleaning equipment
- c. Pressure differential monitor for HEPA local exhaust equipment
- d. Air monitoring equipment
- e. Respirators
- f. Personal protective clothing and equipment

- (1) Coveralls
 - (2) Underclothing
 - (3) Other work clothing
 - (4) Foot coverings
 - (5) Hard hats
 - (6) Eye protection
 - (7) Other items required and approved by Contractors
- Designated IH and Competent Person
- g. Glovebag
 - h. Duct Tape
 - i. Disposal Containers
 - (1) Disposal bags
 - (2) Fiberboard drums
 - (3) Paperboard boxes
 - j. Sheet Plastic
 - (1) Polyethylene Sheet - General
 - (2) Polyethylene Sheet - Flame Resistant
 - (3) Polyethylene Sheet - Reinforced
 - k. Wetting Agent
 - (1) Amended Water
 - (2) Removal encapsulant
 - l. Strippable Coating
 - m. Prefabricated Decontamination Unit
 - n. Other items
 - o. Chemical encapsulant
 - p. Chemical encasement materials
 - q. Material Safety Data Sheets (for all chemicals proposed)

Qualifications; G

A written report providing evidence of qualifications for personnel, facilities and equipment assigned to the work.

Training Program

A copy of the written project site-specific training material as indicated in 29 CFR 1926, Section .1101 that will be used to train onsite employees. The training document shall be signed by the Contractor's Designated IH and Competent Person.

Medical Requirements

Physician's written opinion.

Encapsulants

Certificates stating that encapsulants meet the applicable specified performance requirements.

SD-06 Test Reports

Exposure Assessment and Air Monitoring; G

Initial exposure assessments, negative exposure assessments, air-monitoring results and documentation.

Local Exhaust Ventilation

Pressure differential recordings.

Licenses, Permits and Notifications; G

Licenses, permits, and notifications.

SD-07 Certificates

Vacuum, Filtration and Ventilation Equipment

Manufacturer's certifications showing compliance with ANSI Z9.2 for:

- a. Vacuums.
- b. Water filtration equipment.
- c. Ventilation equipment.
- d. Other equipment required to contain airborne asbestos fibers.

1.5 QUALIFICATIONS

1.5.1 Written Qualifications and Organization Report

The Contractor shall furnish a written qualifications and organization report providing evidence of qualifications of the Contractor, Contractor's Project Supervisor, Designated Competent Person, supervisors and workers; Designated IH (person assigned to project and firm name); independent testing laboratory (including name of firm, principal, and analysts who will perform analyses); all subcontractors to be used including disposal transportation and disposal facility firms, subcontractor supervisors, subcontractor workers; and any others assigned to perform asbestos abatement and support activities. The report shall include an organization chart showing the Contractor's staff organization for this project by name

and title, chain of command and reporting relationship with all subcontractors. The report shall be signed by the Contractor, the Contractor's onsite project manager, Designated Competent Person, Designated IH, designated testing laboratory and the principals of all subcontractors to be used. The Contractor shall include the following statement in the report: "By signing this report I certify that the personnel I am responsible for during the course of this project fully understand the contents of 29 CFR 1926, Section .1101, 40 CFR 61, Subpart M, and the federal, state and local requirements specified in paragraph SAFETY AND HEALTH PROGRAM AND PLANS for those asbestos abatement activities that they will be involved in."

1.5.2 Specific Requirements

The Contractor shall designate in writing, personnel meeting the following qualifications:

- a. Designated Competent Person: The name, address, telephone number, and resume of the Contractor's Designated Competent Person shall be provided. Evidence that the full-time Designated Competent Person is qualified in accordance with 29 CFR 1926, Sections .32 and .1101, has EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training accreditation required by 40 CFR 763, Subpart E, Appendix C, and is experienced in the administration and supervision of asbestos abatement projects, including exposure assessment and monitoring, work practices, abatement methods, protective measures for personnel, setting up and inspecting asbestos abatement work areas, evaluating the integrity of containment barriers, placement and operation of local exhaust systems, ACM generated waste containment and disposal procedures, decontamination units installation and maintenance requirements, site safety and health requirements, notification of other employees onsite, etc. The duties of the Competent Person shall include the following: controlling entry to and exit from the regulated area; supervising any employee exposure monitoring required by 29 CFR 1926, Section .1101; ensuring that all employees working within a regulated area wear the appropriate personal protective equipment (PPE), are trained in the use of appropriate methods of exposure control, and use the hygiene facilities and decontamination procedures specified; and ensuring that engineering controls in use are in proper operating conditions and are functioning properly. The Designated Competent Person shall be responsible for compliance with applicable federal, state and local requirements, the Contractor's Accident Prevention Plan and Asbestos Hazard Abatement Plan. The Designated Competent Person shall provide, and the Contractor shall submit, the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training with the employee "Certificate of Worker Acknowledgment" required by this paragraph. The Contractor shall submit evidence that this person has a minimum of 2 years of on-the-job asbestos abatement experience relevant to OSHA competent person requirements. The Designated Competent Person shall be onsite at all times during the conduct of this project.

- b. Project and Other Supervisors: The Contractor shall provide the name, address, telephone number, and resume of the Project Supervisor and other supervisors who have responsibility to implement the Accident Prevention Plan, including the Asbestos Hazard Abatement Plan and Activity Hazard Analyses, the authority to direct work performed under this contract and verify compliance, and have EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training accreditation required by 40 CFR 763, Subpart E, Appendix C. The Project Supervisor and other supervisors shall provide, and the Contractor shall submit, the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training with the employee "Certificate of Worker Acknowledgment" required by this paragraph. The Contractor shall submit evidence that the Project Supervisor has a minimum of 2 years of on-the-job asbestos abatement experience relevant to project supervisor responsibilities and the other supervisors have a minimum of 1 year on-the-job asbestos abatement experience commensurate with the responsibilities they will have on this project.
- c. Designated Industrial Hygienist: The Contractor shall provide the name, address, telephone number, resume and other information specified below for the Industrial Hygienist (IH) selected to prepare the Contractor's Asbestos Hazard Abatement Plan, prepare and perform training, direct air monitoring and assist the Contractor's Competent Person in implementing and ensuring that safety and health requirements are complied with during the performance of all required work. The Designated IH shall be a person who is board certified in the practice of industrial hygiene as determined and documented by the American Board of Industrial Hygiene (ABIH), has EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training accreditation required by 40 CFR 763, Subpart E, Appendix C, and has a minimum of 2 years of comprehensive experience in planning and overseeing asbestos abatement activities. The Designated IH shall provide, and the Contractor shall submit, the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training with the employee "Certificate of Worker Acknowledgment" required by this paragraph. The Designated IH shall be completely independent from the Contractor according to federal, state, or local regulations; that is, shall not be a Contractor's employee or be an employee or principal of a firm in a business relationship with the Contractor negating such independent status. A copy of the Designated IH's current valid ABIH certification shall be included. The Designated IH shall be onsite at all times for the duration of asbestos activities and shall be available for emergencies. In addition, the Designated IH shall prepare, and the Contractor shall submit, the name, address, telephone numbers and resumes of additional IH's and industrial hygiene technicians (IHT) who will be assisting the Designated IH in performing onsite tasks. IHs and IHTs supporting the Designated IH shall have a minimum of 2 years of practical onsite asbestos abatement experience. The formal reporting

relationship between the Designated IH and the support IHs and IHTs, the Designated Competent Person, and the Contractor shall be indicated.

- d. Asbestos Abatement Workers: Asbestos abatement workers shall meet the requirements contained in 29 CFR 1926, Section .1101, 40 CFR 61, Subpart M, and other applicable federal, state and local requirements. Worker training documentation shall be provided as required on the "Certificate of Workers Acknowledgment" in this paragraph.
- e. Worker Training and Certification of Worker Acknowledgment: Training documentation will be required for each employee who will perform OSHA Class I, Class II, Class III, or Class IV asbestos abatement operations. Such documentation shall be submitted on a Contractor generated form titled "Certificate of Workers Acknowledgment", to be completed for each employee in the same format and containing the same information as the example certificate at the end of this section. Training course completion certificates (initial and most recent update refresher) required by the information checked on the form shall be attached.
- f. Physician: The Contractor shall provide the name, medical qualifications, address, telephone number and resume of the physician who will or has performed the medical examinations and evaluations of the persons who will conduct the asbestos abatement work tasks. The physician shall be currently licensed by the state where the workers will be or have been examined, have expertise in pneumoconiosis and shall be responsible for the determination of medical surveillance protocols and for review of examination/test results performed in compliance with 29 CFR 1926, Section .1101 and paragraph MEDICAL REQUIREMENTS. The physician shall be familiar with the site's hazards and the scope of this project.
- g. First Aid and CPR Trained Persons: The names of at least 2 persons who are currently trained in first aid and CPR by the American Red Cross or other approved agency shall be designated and shall be onsite at all times during site operations. They shall be trained in universal precautions and the use of PPE as described in the Bloodborne Pathogens Standard of 29 CFR 1910, Section .1030 and shall be included in the Contractor's Bloodborne Pathogen Program. These persons may perform other duties but shall be immediately available to render first aid when needed. A copy of each designated person's current valid First Aid and CPR certificate shall be provided.
- h. Independent Testing Laboratory: The Contractor shall provide the name, address and telephone number of the independent testing laboratory selected to perform the sample analyses and report the results. The testing laboratory shall be completely independent from the Contractor as recognized by federal, state or local regulations. Written verification of the following criteria, signed by the testing laboratory principal and the Contractor,

shall be submitted:

(1) Phase contrast microscopy (PCM): The laboratory is fully equipped and proficient in conducting PCM of airborne samples using the methods specified by 29 CFR 1926, Section .1101, OSHA method ID-160, the most current version of NIOSH 84-100 Method 7400, and NIOSH 84-100 Method 7402, transmission electron microscopy (TEM); the laboratory is currently judged proficient (classified as acceptable) in counting airborne asbestos samples by PCM by successful participation in each of the last 4 rounds in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program; the names of the selected microscopists who will analyze airborne samples by PCM with verified documentation of their proficiency to conduct PCM analyses by being judged proficient in counting samples as current participating analysts in the AIHA PAT Program, and having successfully completed the Asbestos Sampling and Analysis course (NIOSH 582 or equivalent) with a copy of course completion certificate provided; when the PCM analysis is to be conducted onsite, documentation shall be provided certifying that the onsite analyst meets the same requirements.

(2) Polarized light microscopy (PLM): The laboratory is fully equipped and proficient in conducting PLM analyses of suspect ACM bulk samples in accordance with 40 CFR 763, Subpart E, Appendix E; the laboratory is currently accredited by NIST under the NVLAP for bulk asbestos analysis and will use analysts (names shall be provided) with demonstrated proficiency to conduct PLM to include its application to the identification and quantification of asbestos content.

(3) Transmission electron microscopy (TEM): The laboratory is fully equipped and proficient in conducting TEM analysis of airborne samples using the mandatory method specified by 40 CFR 763, Subpart E, Appendix E; the laboratory is currently accredited by NIST under the NVLAP for airborne sample analysis of asbestos by TEM; the laboratory will use analysts (names shall be provided) that are currently evaluated as competent with demonstrated proficiency under the NIST NVLAP for airborne sample analysis of asbestos by TEM.

(4) PCM/TEM: The laboratory is fully equipped and each analyst (name shall be provided) possesses demonstrated proficiency in conducting PCM and TEM analysis of airborne samples using NIOSH 84-100 Method 7400 PCM and NIOSH 84-100 Method 7402 (TEM confirmation of asbestos content of PCM results) from the same filter.

- i. Disposal Facility, Transporter: The Contractor shall provide written evidence that the landfill to be used is approved for asbestos disposal by the local regulatory agencies. Copies of signed agreements between the Contractor (including subcontractors and transporters) and the asbestos waste disposal facility to accept and dispose of all asbestos containing waste generated

during the performance of this contract shall be provided. Qualifications shall be provided for each subcontractor or transporter to be used, indicating previous experience in transport and disposal of asbestos waste to include all required state and local waste hauler requirements for asbestos. The Contractor and transporters shall meet the DOT requirements of 49 CFR 171, 49 CFR 172, and 49 CFR 173 as well as registration requirements of 49 CFR 107 and other applicable state or local requirements. The disposal facility shall meet the requirements of 40 CFR 61, Sections .154 or .155, as required in 40 CFR 61, Section .150(b), and other applicable state or local requirements.

1.5.3 Federal, State or Local Citations on Previous Projects

The Contractor and all subcontractors shall submit a statement, signed by an officer of the company, containing a record of any citations issued by Federal, State or local regulatory agencies relating to asbestos activities (including projects, dates, and resolutions); a list of penalties incurred through non-compliance with asbestos project specifications, including liquidated damages, overruns in scheduled time limitations and resolutions; and situations in which an asbestos-related contract has been terminated (including projects, dates, and reasons for terminations). If there are none, a negative declaration signed by an officer of the company shall be provided.

1.6 REGULATORY REQUIREMENTS

In addition to detailed requirements of this specification, work performed under this contract shall comply with EM 385-1-1, applicable federal, state, and local laws, ordinances, criteria, rules and regulations regarding handling, storing, transporting, and disposing of asbestos waste materials. This includes, but is not limited to, OSHA standards, 29 CFR 1926, especially Section .1101, 40 CFR 61, Subpart M and 40 CFR 763. Matters of interpretation of standards shall be submitted to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply. The following state and local laws, rules and regulations regarding demolition, removal, encapsulation, construction alteration, repair, maintenance, renovation, spill/emergency cleanup, housekeeping, handling, storing, transporting and disposing of asbestos material apply:

- 1) Standards Governing Environmental Protection for U.S. Installations in Greenland
- 2) Final Governing Standards (FGS), Chapter 15, Paragraph 15.4
- 3) Thule AB Lead Paint Operating and Management Plans

1.7 SAFETY AND HEALTH PROGRAM AND PLANS

The Contractor shall develop and submit a written comprehensive site-specific Accident Prevention Plan at least 30 days prior to the

preconstruction conference. The Accident Prevention Plan shall address requirements of EM 385-1-1, Appendix A, covering onsite work to be performed by the Contractor and subcontractors. The Accident Prevention Plan shall incorporate an Asbestos Hazard Abatement Plan, and Activity Hazard Analyses as separate appendices into 1 site specific Accident Prevention Plan document. Any portions of the Contractor's overall Safety and Health Program that are referenced in the Accident Prevention Plan, e.g., respirator program, hazard communication program, confined space entry program, etc., shall be included as appendices to the Accident Prevention Plan. The plan shall take into consideration all the individual asbestos abatement work tasks identified in Table 1. The plan shall be prepared, signed (and sealed, including certification number if required), and dated by the Contractor's Designated IH, Competent Person, and Project Supervisor.

1.7.1 Asbestos Hazard Abatement Plan Appendix

The Asbestos Hazard Abatement Plan appendix to the Accident Prevention Plan shall include, but not be limited to, the following:

- a. The personal protective equipment to be used;
- b. The location and description of regulated areas including clean and dirty areas, access tunnels, and decontamination unit (clean room, shower room, equipment room, storage areas such as load-out unit);
- c. Initial exposure assessment in accordance with 29 CFR 1926, Section .1101;
- d. Level of supervision;
- e. Method of notification of other employers at the worksite;
- f. Abatement method to include containment and control procedures;
- g. Interface of trades involved in the construction;
- h. Sequencing of asbestos related work;
- i. Storage and disposal procedures and plan;
- j. Type of wetting agent and asbestos encapsulant to be used;
- k. Location of local exhaust equipment;
- l. Air monitoring methods (personal, environmental and clearance);
- m. Bulk sampling and analytical methods (if required);
- n. A detailed description of the method to be employed in order to control the spread of ACM wastes and airborne fiber concentrations;
- o. Fire and medical emergency response procedures;

- p. The security procedures to be used for all regulated areas.

1.7.2 Activity Hazard Analyses Appendix

Activity Hazard Analyses, for each major phase of work, shall be submitted and updated during the project. The Activity Hazard Analyses format shall be in accordance with EM 385-1-1 (Figure 1-1). The analysis shall define the activities to be performed for a major phase of work, identify the sequence of work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level. Work shall not proceed on that phase until the Activity Hazard Analyses has been accepted and a preparatory meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activities, including the onsite Government representatives. The Activity Hazard Analyses shall be continuously reviewed and, when appropriate, modified to address changing site conditions or operations.

1.8 PRECONSTRUCTION CONFERENCE AND ONSITE SAFETY

The Contractor and the Contractor's Designated Competent Person, Project Supervisor, and Designated IH shall meet with the Contracting Officer prior to beginning work at a safety preconstruction conference to discuss the details of the Contractor's submitted Accident Prevention Plan to include the Asbestos Hazard Abatement Plan and Activity Hazard Analyses appendices. Deficiencies in the Accident Prevention Plan will be discussed and the Accident Prevention Plan shall be revised to correct the deficiencies and resubmitted for acceptance. Any changes required in the specification as a result of the Accident Prevention Plan shall be identified specifically in the plan to allow for free discussion and acceptance by the Contracting Officer, prior to the start of work. Onsite work shall not begin until the Accident Prevention Plan has been accepted. A copy of the written Accident Prevention Plan shall be maintained onsite. Changes and modifications to the accepted Accident Prevention Plan shall be made with the knowledge and concurrence of the Designated IH, the Project Supervisor, Designated Competent Person, and the Contracting Officer. Should any unforeseen hazard become evident during the performance of the work, the Designated IH shall bring such hazard to the attention of the Project Supervisor, Designated Competent Person, and the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, all necessary action shall be taken by the Contractor to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment. Once accepted by the Contracting Officer, the Accident Prevention Plan, including the Asbestos Hazard Abatement Plan and Activity Hazard Analyses will be enforced as if an addition to the contract. Disregarding the provisions of this contract or the accepted Accident Prevention Plan will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

1.9 SECURITY

Fenced and locked security area shall be provided for each regulated area. A log book shall be kept documenting entry into and out of the regulated area. Entry into regulated areas shall only be by personnel authorized by

the Contractor and the Contracting Officer. Personnel authorized to enter regulated areas shall be trained, be medically evaluated, and wear the required personal protective equipment for the specific regulated area to be entered.

1.10 MEDICAL REQUIREMENTS

Medical requirements shall conform to 29 CFR 1926, Section .1101.

1.10.1 Medical Examinations

Before being exposed to airborne asbestos fibers, workers shall be provided with a medical examination as required by 29 CFR 1926, Section .1101 and other pertinent state or local requirements. This requirement shall have been satisfied within the last 12 months. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation. X-ray films of asbestos workers shall be identified to the consulting radiologist and medical record jackets shall be marked with the word "asbestos."

1.10.1.1 Information Provided to the Physician

The Contractor shall provide the following information in writing to the examining physician:

- a. A copy of 29 CFR 1926, Section .1101 and Appendices D, E, G, and I;
- b. A description of the affected employee's duties as they relate to the employee's exposure;
- c. The employee's representative exposure level or anticipated exposure level;
- d. A description of any personal protective and respiratory equipment used or to be used;
- e. Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

1.10.1.2 Written Medical Opinion

For each worker, a written medical opinion prepared and signed by a licensed physician indicating the following:

- a. Summary of the results of the examination.
- b. The potential for an existing physiological condition that would place the employee at an increased risk of health impairment from exposure to asbestos.
- c. The ability of the individual to wear personal protective equipment, including respirators, while performing strenuous work

tasks under cold and/or heat stress conditions.

- d. A statement that the employee has been informed of the results of the examination, provided with a copy of the results, informed of the increased risk of lung cancer attributable to the combined effect of smoking and asbestos exposure, and informed of any medical condition that may result from asbestos exposure.

1.10.2 Medical and Exposure Records

Complete and accurate records shall be maintained of each employee's medical examinations, medical records, and exposure data, as required by 29 CFR 1910, Section .1910.20 and 29 CFR 1926, Section .1101 for a period of 50 years after termination of employment. Records of the required medical examinations and exposure data shall be made available, for inspection and copying, to the Assistant Secretary of Labor for Occupational Safety and Health (OSHA) or authorized representatives of the employee and an employee's physician upon request of the employee or former employee. A copy of the required medical certification for each employee shall be maintained on file at the worksite for review, as requested by the Contracting Officer or the representatives.

1.11 TRAINING PROGRAM

1.11.1 General Training Requirements

The Contractor shall establish a training program as specified by EPA Model Accreditation Plan (MAP), training requirements at 40 CFR 763, Subpart E, Appendix C, OSHA requirements at 29 CFR 1926, Section .1101(k)(9), and this specification. Contractor employees shall complete the required training for the type of work they are to perform and such training shall be documented and provided to the Contracting Officer as specified in paragraph QUALIFICATIONS.

1.11.2 Project Specific Training

Prior to commencement of work, each worker shall be instructed by the Contractor's Designated IH and Competent Person in the following project specific training:

- a. The hazards and health effects of the specific types of ACM to be abated;
- b. The content and requirements of the Contractor's Accident Prevention Plan to include the Asbestos Hazard Abatement Plan and Activity Hazard Analyses and site-specific safety and health precautions;
- c. Hazard Communication Program;
- d. Hands-on training for each asbestos abatement technique to be employed;
- e. Heat and/or cold stress monitoring specific to this project;

- f. Air monitoring program and procedures;
- g. Medical surveillance to include medical and exposure record-keeping procedures;
- h. The association of cigarette smoke and asbestos-related disease;
- i. Security procedures;
- j. Specific work practice controls and engineering controls required for each Class of work in accordance with 29 CFR 1926, Section .1101.

1.12 RESPIRATORY PROTECTION PROGRAM

The Contractor's Designated IH shall establish in writing, and implement a respiratory protection program in accordance with 29 CFR 1926, Section .1101, 29 CFR 1910, Section .134, ANSI Z88.2, CGA G-7, CGA G-7.1 and DETAIL SHEET 12. The Contractor's Designated IH shall establish minimum respiratory protection requirements based on measured or anticipated levels of airborne asbestos fiber concentrations encountered during the performance of the asbestos abatement work. The Contractor's respiratory protection program shall include, but not be limited to, the following elements:

- a. The company policy, used for the assignment of individual responsibility, accountability, and implementation of the respiratory protection program.
- b. The standard operating procedures covering the selection and use of respirators. Respiratory selection shall be determined by the hazard to which the worker is exposed.
- c. Medical evaluation of each user to verify that the worker may be assigned to an activity where respiratory protection is required.
- d. Training in the proper use and limitations of respirators.
- e. Respirator fit-testing, i.e., quantitative, qualitative and individual functional fit checks.
- f. Regular cleaning and disinfection of respirators.
- g. Routine inspection of respirators during cleaning and after each use when designated for emergency use.
- h. Storage of respirators in convenient, clean, and sanitary locations.
- i. Surveillance of regulated area conditions and degree of employee exposure (e.g., through air monitoring).
- j. Regular evaluation of the continued effectiveness of the respiratory protection program.

- k. Recognition and procedures for the resolution of special problems as they affect respirator use (e.g., no facial hair that comes between the respirator face piece and face or interferes with valve function; prescription eye wear usage; contact lenses usage; etc.).

- l. Proper training in putting on and removing respirators.

1.12.1 Respiratory Fit Testing

A qualitative or quantitative fit test conforming to 29 CFR 1926, Section 1101, Appendix C shall be conducted by the Contractor's Designated IH for each Contractor worker required to wear a respirator, and for the Contracting Officer and authorized visitors who enter a regulated area where respirators are required to be worn. A respirator fit test shall be performed for each worker wearing a negative-pressure respirator prior to initially wearing a respirator on this project and every 6 months thereafter. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permitted to be worn, or of full-facepiece air purifying respirators where they are worn at levels at which half-facepiece air purifying respirators are permitted. If physical changes develop that will affect the fit, a new fit test for the worker shall be performed. Functional fit checks shall be performed by employees each time a respirator is put on and in accordance with the manufacturer's recommendation.

1.12.2 Respirator Selection and Use Requirements

The Contractor shall provide respirators, and ensure that they are used as required by 29 CFR 1926, Section .1101 and in accordance with the manufacturer's recommendations. Respirators shall be jointly approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health (MSHA/NIOSH), or by NIOSH, under the provisions of 42 CFR 84, for use in environments containing airborne asbestos fibers. Personnel who handle ACM, enter regulated areas that require the wearing of a respirator, or who are otherwise carrying out abatement activities that require the wearing of a respirator, shall be provided with approved respirators that are fully protective of the worker at the measured or anticipated airborne asbestos concentration level to be encountered. For air-purifying respirators, the particulate filter portion of the cartridges or canister approved for use in airborne asbestos environments shall be high-efficiency particulate air (HEPA). The initial respirator selection and the decisions regarding the upgrading or downgrading of respirator type shall be made by the Contractor's Designated IH based on the measured or anticipated airborne asbestos fiber concentrations to be encountered. Recommendations made by the Contractor's Designated IH to downgrade respirator type shall be submitted in writing to the Contracting Officer. The Contractor's Designated Competent Person in consultation with the Designated IH, shall have the authority to take immediate action to upgrade or downgrade respiratory type when there is an immediate danger to the health and safety of the wearer. Respirators shall be used in the following circumstances:

- a. During all Class I asbestos jobs.

- b. During all Class II work where the ACM is not removed in a substantially intact state.
- c. During all Class II and III work which is not performed using wet methods. Respirators need not be worn during removal of ACM from sloped roofs when a negative exposure assessment has been made and ACM is removed in an intact state.
- d. During all Class II and III asbestos jobs where the Contractor does not produce a negative exposure assessment.
- e. During all Class III jobs where TSI or surfacing ACM is being disturbed.
- f. During all Class IV work performed within regulated areas where employees performing other work are required to wear respirators.
- g. During all work where employees are exposed above the PEL-TWA or PEL-Excursion Limit.
- h. In emergencies

1.12.3 Class I Work

The Contractor shall provide: (1) a tight-fitting, powered air purifying respirator equipped with high efficiency filters, or (2) a full-facepiece supplied air respirator operated in the pressure demand mode, equipped with HEPA egress cartridges, or (3) an auxiliary positive pressure self-contained breathing apparatus, for all employees within the regulated area where Class I work is being performed; provided that a negative exposure assessment has not been produced, and that the exposure level will not exceed 1 f/cc as an 8-hour time weighted average. A full-facepiece supplied air respirator, operated in the pressure demand mode, equipped with an auxiliary positive pressure self-contained breathing apparatus shall be provided under such conditions, if the exposure assessment indicates exposure levels above 1 f/cc as an 8-hour time weighted average.

1.12.4 Class II and III Work

The Contractor shall provide an air purifying respirator, other than a disposable respirator, equipped with high-efficiency filters whenever the employee performs Class II and III asbestos jobs where the Contractor does not produce a negative exposure assessment ; and Class III jobs where TSI or surfacing ACM is being disturbed.

1.12.5 Sanitation

Employees who wear respirators shall be permitted to leave work areas to wash their faces and respirator facepieces whenever necessary to prevent skin irritation associated with respirator use.

1.13 HAZARD COMMUNICATION PROGRAM

A hazard communication program shall be established and implemented in accordance with 29 CFR 1926, Section .59. Material safety data sheets (MSDSs) shall be provided for all hazardous materials brought onto the worksite. One copy shall be provided to the Contracting Officer and 1 copy shall be included in the Contractor's Hazard Communication Program.

1.14 LICENSES, PERMITS AND NOTIFICATIONS

1.14.1 General Legal Requirements

Necessary licenses, permits and notifications shall be obtained in conjunction with the project's asbestos abatement, transportation and disposal actions and timely notification furnished of such actions as required by federal, state, regional, and local authorities. The Contractor shall notify the local air pollution control district/agency and the Contracting Officer in writing, at least 10 days prior to the commencement of work, in accordance with 40 CFR 61, Subpart M, and state and local requirements to include the mandatory "Notification of Demolition and Renovation Record" form and other required notification documents. Notification shall be by Certified Mail, Return Receipt Requested. The Contractor shall furnish copies of the receipts to the Contracting Officer, in writing, prior to the commencement of work. Local fire department shall be notified 3 days before fire-proofing material is removed from a building and the notice shall specify whether or not the material contains asbestos.

A copy of the rental company's written acknowledgment and agreement shall be provided as required by paragraph RENTAL EQUIPMENT. For licenses, permits, and notifications that the Contractor is responsible for obtaining, the Contractor shall pay any associated fees or other costs incurred.

1.14.2 Litigation and Notification

The Contractor shall notify the Contracting Officer if any of the following occur:

- a. The Contractor or any of the subcontractors are served with notice of violation of any law, regulation, permit or license which relates to this contract;
- b. Proceedings are commenced which could lead to revocation of related permits or licenses; permits, licenses or other Government authorizations relating to this contract are revoked;
- c. Litigation is commenced which would affect this contract;
- d. The Contractor or any of the subcontractors become aware that their equipment or facilities are not in compliance or may fail to comply in the future with applicable laws or regulations.

1.15 PERSONAL PROTECTIVE EQUIPMENT

Three complete sets of personal protective equipment shall be made

available to the Contracting Officer and authorized visitors for entry to the regulated area. Contracting Officer and authorized visitors shall be provided with training equivalent to that provided to Contractor employees in the selection, fitting, and use of the required personal protective equipment and the site safety and health requirements. Contractor workers shall be provided with personal protective clothing and equipment and the Contractor shall ensure that it is worn properly. The Contractor's Designated IH and Designated Competent Person shall select and approve all the required personal protective clothing and equipment to be used.

1.15.1 Respirators

Respirators shall be in accordance with paragraph RESPIRATORY PROTECTION PROGRAM.

1.15.2 Whole Body Protection

Personnel exposed to airborne concentrations of asbestos that exceed the PELs, or for all OSHA Classes of work for which a required negative exposure assessment is not produced, shall be provided with whole body protection and such protection shall be worn properly. The Contractor's Designated IH and Competent Person shall select and approve the whole body protection to be used. The Competent Person shall examine work suits worn by employees at least once per work shift for rips or tears that may occur during performance of work. When rips or tears are detected while an employee is working, rips and tears shall be immediately mended, or the work suit shall be immediately replaced. Disposable whole body protection shall be disposed of as asbestos contaminated waste upon exiting from the regulated area. Reusable whole body protection worn shall be either disposed of as asbestos contaminated waste upon exiting from the regulated area or be properly laundered in accordance with 29 CFR 1926, Section .1101.

Whole body protection used for asbestos abatement shall not be removed from the worksite by a worker to be cleaned. Recommendations made by the Contractor's Designated IH to downgrade whole body protection shall be submitted in writing to the Contracting Officer. The Contractor's Designated Competent Person, in consultation with the Designated IH, has the authority to take immediate action to upgrade or downgrade whole body protection when there is an immediate danger to the health and safety of the wearer.

1.15.2.1 Coveralls

Disposable-breathable coveralls with a zipper front shall be provided. Sleeves shall be secured at the wrists, and foot coverings secured at the ankles. See DETAIL SHEET 13.

1.15.2.2 Underwear

Disposable underwear shall be provided. If reusable underwear are used, they shall be disposed of as asbestos contaminated waste or laundered in accordance with 29 CFR 1926, Section .1101. Asbestos abatement workers shall not remove contaminated reusable underwear worn during abatement of ACM from the site to be laundered.

1.15.2.3 Work Clothing

An additional coverall shall be provided when the abatement and control method employed does not provide for the exit from the regulated area directly into an attached decontamination unit. Cloth work clothes for wear under the protective coverall, and foot coverings, shall be provided when work is being conducted in low temperature conditions. Cloth work clothes shall be either disposed of as asbestos contaminated waste or properly laundered in accordance with 29 CFR 1926, Section .1101.

1.15.2.4 Gloves

Gloves shall be provided to protect the hands. Where there is the potential for hand injuries (i.e., scrapes, punctures, cuts, etc.) a suitable glove shall be provided and used.

1.15.2.5 Foot Coverings

Cloth socks shall be provided and worn next to the skin. Footwear, as required by OSHA and EM 385-1-1, that is appropriate for safety and health hazards in the area shall be worn. Rubber boots shall be used in moist or wet areas. Reusable footwear removed from the regulated area shall be thoroughly decontaminated or disposed of as ACM waste. Disposable protective foot covering shall be disposed of as ACM waste. If rubber boots are not used, disposable foot covering shall be provided.

1.15.2.6 Head Covering

Hood type disposable head covering shall be provided. In addition, protective head gear (hard hats) shall be provided as required. Hard hats shall only be removed from the regulated area after being thoroughly decontaminated.

1.15.2.7 Protective Eye Wear

Eye protection provided shall be in accordance with ANSI Z87.1.

1.16 HYGIENE FACILITIES AND PRACTICES

The Contractor shall establish a decontamination area for the decontamination of employees, material and equipment. The Contractor shall ensure that employees enter and exit the regulated area through the decontamination area.

1.16.1 Shower Facilities

Shower facilities, when provided, shall comply with 29 CFR 1910, Section .141(d)(3).

1.16.2 3-Stage Decontamination Area

A temporary negative pressure decontamination unit that is adjacent and attached in a leak-tight manner to the regulated area shall be provided as described in SET-UP DETAIL SHEET Numbers 22 and 23. Utilization of prefabricated units shall have prior approval of the Contracting Officer.

The decontamination unit shall have an equipment room and a clean room separated by a shower that complies with 29 CFR 1910, Section .141 (unless the Contractor can demonstrate that such facilities are not feasible). Equipment and surfaces of containers filled with ACM shall be cleaned prior to removing them from the equipment room or area. Surfaces of the equipment room shall be wet wiped 2 times after each shift. Materials used for wet wiping shall be disposed of as asbestos contaminated waste. Two separate lockers shall be provided for each asbestos worker, one in the equipment room and one in the clean room. Should sufficient hot water be unavailable, the Contractor shall provide a minimum 160 L electric water heater with minimum recovery rate of 80 L per hour and a temperature controller for each showerhead. The Contractor shall provide a minimum of 2 showers. Instantaneous type in-line water heater may be incorporated at each shower head in lieu of hot water heater, upon approval by the Contracting Officer. Flow and temperature controls shall be located within the shower and shall be adjustable by the user. The wastewater pump shall be sized for 1.25 times the showerhead flow-rate at a pressure head sufficient to satisfy the filter head loss and discharge line losses. The pump shall supply a minimum 1.6 L/s flow with 10.7 m of pressure head. Used shower water shall be collected and filtered to remove asbestos contamination. Filters and residue shall be disposed of as asbestos contaminated material, per DETAIL SHEETS 9 and 14. Filtered water shall be discharged to the sanitary system. Wastewater filters shall be installed in series with the first stage pore size of 20 microns and the second stage pore size of 5 microns. The floor of the decontamination unit's clean room shall be kept dry and clean at all times. Water from the shower shall not be allowed to wet the floor in the clean room. Surfaces of the clean room and shower shall be wet-wiped 2 times after each shift change with a disinfectant solution. Proper housekeeping and hygiene requirements shall be maintained. Soap and towels shall be provided for showering, washing and drying. Any cloth towels provided shall be disposed of as ACM waste or shall be laundered in accordance with 29 CFR 1926, Section .1101.

1.16.3 Load-Out Unit

A temporary load-out unit that is adjacent and connected to the regulated area and shall be provided as described in DETAIL SHEET Number 20 . Utilization of prefabricated units shall have prior approval of the Contracting Officer. The load-out unit shall be attached in a leak-tight manner to each regulated area. Surfaces of the load-out unit and access tunnel shall be adequately wet-wiped 2 times after each shift change. Materials used for wet wiping shall be disposed of as asbestos contaminated waste.

1.16.4 Single Stage Decontamination Area

A decontamination area (equipment room/area) shall be provided for Class I work involving less than 7.5 m or 0.9 square meters of TSI or surfacing ACM, and for Class II and Class III asbestos work operations where exposures exceed the PELs or where there is no negative exposure assessment produced before the operation. The equipment room or area shall be adjacent to the regulated area for the decontamination of employees, material, and their equipment which is contaminated with asbestos. The equipment room or area shall consist of an area covered by an impermeable

drop cloth on the floor or horizontal working surface. The area must be of sufficient size to accommodate cleaning of equipment and removing personal protective equipment without spreading contamination beyond the area. Surfaces of the equipment room shall be wet wiped 2 times after each shift.

Materials used for wet wiping shall be disposed of as asbestos contaminated waste.

1.16.5 Decontamination Area Entry Procedures

The Contractor shall ensure that employees entering the decontamination area through the clean room or clean area:

- a. Remove street clothing in the clean room or clean area and deposit it in lockers.
- b. Put on protective clothing and respiratory protection before leaving the clean room or clean area.
- c. Pass through the equipment room to enter the regulated area.

1.16.6 Decontamination Area Exit Procedures

The Contractor shall ensure that the following procedures are followed:

- a. Before leaving the regulated area, respirators shall be worn while employees remove all gross contamination and debris from their work clothing using a HEPA vacuum.
- b. Employees shall remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers (see Detail Sheets 9 and 14) for disposal and/or laundering.
- c. Employees shall not remove their respirators in the equipment room.
- d. Employees shall shower prior to entering the clean room. If a shower has not been located between the equipment room and the clean room or the work is performed outdoors, the Contractor shall ensure that employees engaged in Class I asbestos jobs: a) Remove asbestos contamination from their work suits in the equipment room or decontamination area using a HEPA vacuum before proceeding to a shower that is not adjacent to the work area; or b) Remove their contaminated work suits in the equipment room, without cleaning worksuits, and proceed to a shower that is not adjacent to the work area.
- e. After showering, employees shall enter the clean room before changing into street clothes.

1.16.7 Lunch Areas

The Contractor shall provide lunch areas in which the airborne concentrations of asbestos are below 0.01 f/cc.

1.16.8 Smoking

Smoking, if allowed by the Contractor, shall only be permitted in designated areas approved by the Contracting Officer.

1.17 REGULATED AREAS

All Class I, II, and III asbestos work shall be conducted within regulated areas. The regulated area shall be demarcated to minimize the number of persons within the area and to protect persons outside the area from exposure to airborne asbestos. Where critical barriers or negative pressure enclosures are used, they shall demarcate the regulated area. Access to regulated areas shall be limited to authorized persons. The Contractor shall control access to regulated areas, ensure that only authorized personnel enter, and verify that Contractor required medical surveillance, training and respiratory protection program requirements are met prior to allowing entrance.

1.18 WARNING SIGNS AND TAPE

Warning signs and tape printed bilingually in English and host language shall be provided at the regulated boundaries and entrances to regulated areas. The Contractor shall ensure that all personnel working in areas contiguous to regulated areas comprehend the warning signs. Signs shall be located to allow personnel to read the signs and take the necessary protective steps required before entering the area. Warning signs, as shown and described in DETAIL SHEET 11, shall be in vertical format conforming to 29 CFR 1910 and 29 CFR 1926, Section .1101, a minimum of 500 by 350 mm , and displaying the following legend in the lower panel:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

Spacing between lines shall be at least equal to the height of the upper of any two lines. Warning tape shall be provided as shown and described on DETAIL SHEET 11. Decontamination unit signage shall be as shown and described on DETAIL SHEET 15.

1.19 WARNING LABELS

Warning labels shall be affixed to all asbestos disposal containers used to contain asbestos materials, scrap, waste debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to requirements are acceptable. Warning labels shall be as described in DETAIL SHEET 14, shall conform to 29 CFR 1926, Section .1101 and shall be of sufficient size to be clearly legible displaying the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

1.20 LOCAL EXHAUST VENTILATION

Local exhaust ventilation units shall conform to ANSI Z9.2 and 29 CFR 1926, Section .1101. Filters on local exhaust system equipment shall conform to ANSI Z9.2 and UL 586. Filter shall be UL labeled.

1.21 TOOLS

Vacuums shall be leak proof to the filter, equipped with HEPA filters, of sufficient capacity and necessary capture velocity at the nozzle or nozzle attachment to efficiently collect, transport and retain the ACM waste material. Power tools shall not be used to remove ACM unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation capture and collection system, or has otherwise been approved for use by the Contracting Officer. Residual asbestos shall be removed from reusable tools prior to storage and reuse. Reusable tools shall be thoroughly decontaminated prior to being removed from regulated areas.

1.22 RENTAL EQUIPMENT

If rental equipment is to be used, written notification shall be provided to the rental agency, concerning the intended use of the equipment, the possibility of asbestos contamination of the equipment and the steps that will be taken to decontaminate such equipment. A written acceptance of the terms of the Contractor's notification shall be obtained from the rental agency.

1.23 AIR MONITORING EQUIPMENT

The Contractor's Designated IH shall approve air monitoring equipment to be used to collect samples. The equipment shall include, but shall not be limited to:

- a. High-volume sampling pumps that can be calibrated and operated at a constant airflow up to 16 liters per minute when equipped with a sampling train of tubing and filter cassette.
- b. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute when equipped with a sampling train of tubing and filter cassette, and a self-contained rechargeable power pack capable of sustaining the calibrated flow rate for a minimum of 10 hours. The pumps shall also be equipped with an automatic flow control unit which shall maintain a constant flow, even as filter resistance increases due to accumulation of fiber and debris on the filter surface.
- c. Single use standard 25 mm diameter cassette, open face, 0.8 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive extension cowl, and shrink bands, to be used with low flow pumps in accordance with 29 CFR 1926, Section .1101 for personal air sampling.

- d. Single use standard 25 mm diameter cassette, open face, 0.45 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive cowl, and shrink bands, to be used with high flow pumps when conducting environmental area sampling using NIOSH 84-100 Methods 7400 and 7402, (and the transmission electric microscopy method specified at 40 CFR 763 if required).
- e. Appropriate plastic tubing to connect the air sampling pump to the selected filter cassette.
- f. A flow calibrator capable of calibration to within plus or minus 2 percent of reading over a temperature range of minus 20 to plus 60 degrees C and traceable to a NIST primary standard.

1.24 EXPENDABLE SUPPLIES

1.24.1 Glovebag

Glovebags shall be provided as described in 29 CFR 1926, Section .1101 and SET-UP DETAIL SHEET 10. The glovebag assembly shall be 0.15 mm thick plastic, prefabricated and seamless at the bottom with preprinted OSHA warning label.

1.24.2 Duct Tape

Industrial grade duct tape of appropriate widths suitable for bonding sheet plastic and disposal container shall be provided.

1.24.3 Disposal Containers

Leak-tight (defined as solids, liquids, or dust that cannot escape or spill out) disposal containers shall be provided for ACM wastes as required by 29 CFR 1926 Section .1101 and DETAIL SHEETS 9A, 9B, 9C and 14.

1.24.4 Disposal Bags

Leak-tight bags, 0.15 mm thick, shall be provided for placement of asbestos generated waste as described in DETAIL SHEET 9A.

1.24.5 Sheet Plastic

Sheet plastic shall be polyethylene of 0.15 mm minimum thickness and shall be provided in the largest sheet size necessary to minimize seams, as indicated on the project drawings. Film shall be black and conform to ASTM D 4397, except as specified below:

1.24.6 Amended Water

Amended water shall meet the requirements of ASTM D 1331.

1.24.7 Leak-tight Wrapping

Two layers of 0.15 mm minimum thick polyethylene sheet stock shall be used for the containment of removed asbestos-containing components or materials such as reactor vessels, large tanks, boilers, insulated pipe segments and other materials too large to be placed in disposal bags as described in DETAIL SHEET 9B. Upon placement of the ACM component or material, each layer shall be individually leak-tight sealed with duct tape.

1.24.8 Wetting Agents

Removal encapsulant (a penetrating encapsulant) shall be provided when conducting removal abatement activities that require a longer removal time or are subject to rapid evaporation of amended water. The removal encapsulant shall be capable of wetting the ACM and retarding fiber release during disturbance of the ACM greater than or equal to that provided by amended water. Performance requirements for penetrating encapsulants are specified in paragraph ENCAPSULANTS.

1.25 MISCELLANEOUS ITEMS

A sufficient quantity of other items, such as, but not limited to: scrapers, brushes, brooms, staple guns, tarpaulins, shovels, rubber squeegees, dust pans, other tools, scaffolding, staging, enclosed chutes, wooden ladders, lumber necessary for the construction of containments, UL approved temporary electrical equipment, material and cords, ground fault circuit interrupters, water hoses of sufficient length, fire extinguishers, first aid kits, portable toilets, logbooks, log forms, markers with indelible ink, spray paint in bright color to mark areas, project boundary fencing, etc., shall be provided.

PART 2 PRODUCTS

2.1 ENCAPSULANTS

Encapsulants shall conform to USEPA requirements, shall contain no toxic or hazardous substances and no solvent and shall meet the following requirements:

ALL ENCAPSULANTS

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	ASTM E 84
Combustion Toxicity Zero Mortality	Univ. of Pittsburgh Protocol
Life Expectancy, 20 yrs Accelerated Aging Test	ASTM C 732
Permeability, Min. 23 ng per Pa-sec-square m	ASTM E 96

Additional Requirements for Bridging Encapsulant

ALL ENCAPSULANTS

Requirement	Test Standard
Requirement	Test Standard
Cohesion/Adhesion Test, 730 N/m	ASTM E 736
Fire Resistance, Negligible affect on fire resistance rating over 3 hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E 119
Impact Resistance, Min. 4.7 N-m (Gardner Impact Test)	ASTM D 2794
Flexibility, no rupture or cracking (Mandrel Bend Test)	ASTM D 522

Additional Requirements for Penetrating Encapsulant

Requirement	Test Standard
Cohesion/Adhesion Test, 730 N/m	ASTM E 736
Fire Resistance, Negligible affect on fire resistance rating over 3 hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E 119
Impact Resistance, Min. 4.7 N-m (Gardner Impact Test)	ASTM D 2794
Flexibility, no rupture or cracking (Mandrel Bend Test)	ASTM D 522

Additional Requirements for Lockdown Encapsulant

Requirement	Test Standard
Fire Resistance, Negligible affect on fire resistance rating over 3 hour test (Tested with fireproofing over encapsulant applied directly to steel member)	ASTM E 119
Bond Strength, 1.5 kN/m (Tests compatibility with cementitious and fibrous fireproofing)	ASTM E 736

2.2 ENCASMENT PRODUCTS

Encasement shall consist of primary cellular polymer coat, polymer finish coat, and any other finish coat as approved by the Contracting Officer.

2.3 RECYCLABLE MATERIALS

The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Asbestos abatement work tasks shall be performed as shown on the detailed plans and drawings, as summarized in paragraph DESCRIPTION OF WORK and including Table 1 and the Contractor's Accident Prevention Plan, Asbestos Hazard Abatement Plan, and the Activity Hazard Analyses. The Contractor shall use the engineering controls and work practices required in 29 CFR 1926, Section .1101(g) in all operations regardless of the levels of exposure. Personnel shall wear and utilize protective clothing and equipment as specified. The Contractor shall not permit eating, smoking, drinking, chewing or applying cosmetics in the regulated area. All hot work (burning, cutting, welding, etc.) shall be conducted under controlled conditions in conformance with 29 CFR 1926, Section .352, Fire Prevention. Personnel of other trades, not engaged in asbestos abatement activities, shall not be exposed at any time to airborne concentrations of asbestos unless all the administrative and personal protective provisions of the Contractor's Accident Prevention Plan are complied with. Power to the regulated area shall be locked-out and tagged in accordance with 29 CFR 1910, and temporary electrical service with ground fault circuit interrupters shall be provided as needed. Temporary electrical service shall be disconnected when necessary for wet removal. The Contractor shall stop abatement work in the regulated area immediately when the airborne total fiber concentration: (1) equals or exceeds 0.01 f/cc, or the pre-abatement concentration, whichever is greater, outside the regulated area; or (2) equals or exceeds 1.0 f/cc inside the regulated area. The Contractor shall correct the condition to the satisfaction of the Contracting Officer, including visual inspection and air sampling. Work shall resume only upon notification by the Contracting Officer. Corrective actions shall be documented.

3.2 PROTECTION OF ADJACENT WORK OR AREAS TO REMAIN

Asbestos abatement shall be performed without damage to or contamination of adjacent work or area. Where such work or area is damaged or contaminated, as verified by the Contracting Officer using visual inspection or sample analysis, it shall be restored to its original condition or decontaminated by the Contractor at no expense to the Government, as deemed appropriate by the Contracting Officer. This includes inadvertent spill of dirt, dust or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, work shall stop in all effected areas immediately and the spill shall be cleaned. When satisfactory visual inspection and air sampling analysis results are obtained and have been evaluated by the Contractor's Designated IH and the Contracting Officer, work shall proceed.

3.3 OBJECTS

3.3.1 Removal of Mobile Objects

Mobile objects, furniture, and equipment will be removed from the area of work by the Government before asbestos abatement work begins.

3.4 BUILDING VENTILATION SYSTEM AND CRITICAL BARRIERS

Building ventilating systems supplying air into or returning air out of a regulated area shall be isolated by airtight seals to prevent the spread of contamination throughout the system. The critical barriers shall consist of 2 layers of polyethylene. Edges to wall, ceiling and floor surfaces shall be sealed with industrial grade duct tape. Critical barriers shall be installed as shown on drawings and appended SET-UP DETAIL SHEETS.

3.5 PRECLEANING

Surfaces shall be cleaned by HEPA vacuum prior to establishment of containment.

3.6 METHODS OF COMPLIANCE

3.6.1 Mandated Practices

The Contractor shall employ proper handling procedures in accordance with 29 CFR 1926 and 40 CFR 61, Subpart M, and the specified requirements. The specific abatement techniques and items identified shall be detailed in the Contractor's Asbestos Hazard Abatement Plan including, but not limited to, details of construction materials, equipment, and handling procedures. The Contractor shall use the following engineering controls and work practices in all operations, regardless of the levels of exposure:

- a. Vacuum cleaners equipped with HEPA filters to collect debris and dust containing ACM.
- b. Wet methods or wetting agents to control employee exposures during asbestos handling, mixing, removal, cutting, application, and cleanup; except where it can be demonstrated that the use of wet methods is unfeasible due to, for example, the creation of electrical hazards, equipment malfunction, and in roofing.
- c. Prompt clean-up and disposal in leak-tight containers of wastes and debris contaminated with asbestos.
- d. Inspection and repair of polyethylene in work and high traffic areas.
- e. Cleaning of equipment and surfaces of containers filled with ACM prior to removing them from the equipment room or area.

3.6.2 Control Methods

The Contractor shall use the following control methods to comply with the

PELs:

- a. Local exhaust ventilation equipped with HEPA filter dust collection systems;
- b. Enclosure or isolation of processes producing asbestos dust;
- c. Ventilation of the regulated area to move contaminated air away from the breathing zone of employees and toward a filtration or collection device equipped with a HEPA filter;
- d. Use of other work practices and engineering controls;
- e. Where the feasible engineering and work practice controls described above are not sufficient to reduce employee exposure to or below the PELs, the Contractor shall use them to reduce employee exposure to the lowest levels attainable by these controls and shall supplement them by the use of respiratory protection that complies with paragraph, RESPIRATORY PROTECTION PROGRAM.

3.6.3 Unacceptable Practices

The following work practices and engineering controls shall not be used for work related to asbestos or for work which disturbs ACM, regardless of measured levels of asbestos exposure or the results of initial exposure assessments:

- a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.
- b. Compressed air used to remove asbestos, or materials containing asbestos, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.
- c. Dry sweeping, shoveling, or other dry clean-up of dust and debris containing ACM.
- d. Employee rotation as a means of reducing employee exposure to asbestos.

3.6.4 Class I Work Procedures

In addition to requirements of paragraphs Mandated Practices and Control Methods, the following engineering controls and work practices shall be used:

- a. A Competent Person shall supervise the installation and operation of the control system.
- b. For jobs involving the removal of more than 7.5 m or 0.9 square meters of TSI or surfacing material, the Contractor shall place critical barriers over all openings to the regulated area.

- c. HVAC systems shall be isolated in the regulated area by sealing with a double layer of plastic or air-tight rigid covers.
- d. Impermeable dropcloths (0.15 mm or greater thickness) shall be placed on surfaces beneath all removal activity.
- e. Objects within the regulated area shall be handled as specified in paragraph OBJECTS.
- f. Where a negative exposure assessment has not been provided or where exposure monitoring shows the PEL was exceeded, the regulated area shall be ventilated to move contaminated air away from the employee's breathing zone toward a HEPA unit or collection device.

3.6.5 Specific Control Methods for Class I Work

In addition to requirements of paragraph Class I Work Procedures, Class I asbestos work shall be performed using the control methods identified in the subparagraphs below.

3.6.5.1 Glovebag Systems

Glovebag systems shall be as shown in SETUP DETAIL SHEET 10. The glovebag system shall be used to remove ACM from straight runs of piping and elbows and other connections. Glovebags shall be used without modification and shall be smoke-tested for leaks and any leaks sealed prior to use. Glovebags shall be installed to completely cover the circumference of pipe or other structures where the work is to be done. Glovebags shall be used only once and shall not be moved. Glovebags shall not be used on surfaces that have temperatures exceeding 66 degrees C. Prior to disposal, glovebags shall be collapsed by removing air within them using a HEPA vacuum. Before beginning the operation, loose and friable material adjacent to the glovebag operation shall be wrapped and sealed in 2 layers of plastic or otherwise rendered intact. At least 2 persons shall perform Class I glovebag removal. Asbestos regulated work areas shall be established as specified and shown on detailed drawings and plans for glovebag abatement. Designated boundary limits for the asbestos work shall be established with rope or other continuous barriers and all other requirements for asbestos control areas shall be maintained, including area signage and boundary warning tape as specified in SET-UP DETAIL SHEET 11.

- a. In addition to requirements for negative pressure glovebag systems above, the Contractor shall attach HEPA vacuum systems or other devices to the bag to prevent collapse during removal of ACM from straight runs of piping and elbows and other connections.
- b. The negative pressure glove boxes used to remove ACM from pipe runs shall be fitted with gloved apertures and a bagging outlet and constructed with rigid sides from metal or other material which can withstand the weight of the ACM and water used during removal. A negative pressure shall be created in the system using a HEPA filtration system. The box shall be smoke tested for leaks

prior to each use.

3.6.5.2 Wrap and Cut Operation

Wrap and cut operations shall be as shown in SETUP DETAIL SHEET 10. Prior to cutting pipe, the asbestos-containing insulation shall be wrapped with polyethylene and securely sealed with duct tape to prevent asbestos becoming airborne as a result of the cutting process. The following steps shall be taken: install glovebag, strip back sections to be cut 150 mm from point of cut, and cut pipe into manageable sections.

3.6.6 Class II Work

In addition to the requirements of paragraphs Mandated Practices and Control Methods, the following engineering controls and work practices shall be used:

- a. A Competent Person shall supervise the work.
- b. For indoor work, critical barriers shall be placed over all openings to the regulated area.
- c. Impermeable dropcloths shall be placed on surfaces beneath all removal activity.

3.6.7 Specific Control Methods for Class II Work

In addition to requirements of paragraph Class II Work, Class II work shall be performed using the following methods:

3.6.7.1 Other Class II Jobs

The Contractor shall use the following work practices when performing Class II removal of flexible connector ACM: The material shall be thoroughly wetted with amended water prior and during its removal. The material shall be removed in an intact state. Cutting, abrading or breaking the material is prohibited. The ACM removed shall be immediately bagged or wrapped.

3.6.8 Cleaning After Asbestos Removal

After completion of all asbestos removal work, surfaces from which ACM has been removed shall be wet wiped or sponged clean, or cleaned by some equivalent method to remove all visible residue. Run-off water shall be collected and filtered through a dual filtration system. A first filter shall be provided to remove fibers 20 micrometers and larger, and a final filter provided that removes fibers 5 micrometers and larger. After the gross amounts of asbestos have been removed from every surface, remaining visible accumulations of asbestos on floors shall be collected using plastic shovels, rubber squeegees, rubber dustpans, and HEPA vacuum cleaners as appropriate to maintain the integrity of the regulated area. When TSI and surfacing material has been removed, workmen shall use HEPA vacuum cleaners to vacuum every surface. Surfaces or locations which could harbor accumulations or residual asbestos dust shall be checked after vacuuming to verify that no asbestos-containing material remains; and shall

be re-vacuumed as necessary to remove the ACM.

3.6.9 Class I Asbestos Work Response Action Detail Sheets

The following Class I Asbestos Work Response Action Detail Sheet is specified on Table 1 for each individual work task to be performed:

- a. Pipe and Fitting Insulation (using Glovebag): See Sheet 86

3.6.10 Class II Asbestos Work Response Action Detail Sheets

The following Class II Asbestos Work Response Action Detail Sheet is specified on Table 1 for each individual work task to be performed:

- a. Miscellaneous Asbestos-Containing Materials: See Sheet 45

3.7 FINAL CLEANING AND VISUAL INSPECTION

Upon completion of abatement, the regulated area shall be cleaned by collecting, packing, and storing all gross contamination; see SET-UP DETAIL SHEETS 9, 14 and 20. A final cleaning shall be performed using HEPA vacuum and wet cleaning of all exposed surfaces and objects in the regulated area. Upon completion of the cleaning, the Contractor shall conduct a visual pre-inspection of the cleaned area in preparation for a final inspection before final air clearance monitoring and recleaning, as necessary. Upon completion of the final cleaning, the Contractor and the Contracting Officer shall conduct a final visual inspection of the cleaned regulated area in accordance with ASTM E 1368 and document the results on the Final Cleaning and Visual Inspection as specified on the SET-UP DETAIL SHEET 19. If the Contracting Officer rejects the clean regulated area as not meeting final cleaning requirements, the Contractor shall reclean as necessary and have a follow-on inspection conducted with the Contracting Officer. Recleaning and follow-up reinspection shall be at the Contractor's expense.

3.8 LOCKDOWN

Prior to removal of plastic barriers and after clean-up of gross contamination and final visual inspection, a post removal (lockdown) encapsulant shall be spray applied to ceiling, walls, floors, and other surfaces in the regulated area.

3.9 EXPOSURE ASSESSMENT AND AIR MONITORING

3.9.1 General Requirements For Exposure

Exposure assessment, air monitoring and analysis of airborne concentration of asbestos fibers shall be performed in accordance with 29 CFR 1926, Section .1101, the Contractor's air monitoring plan, and as specified. Personal exposure air monitoring (collected at the breathing zone) that is representative of the exposure of each employee who is assigned to work within a regulated area shall be performed by the Contractor's Designated IH. Breathing zone samples shall be taken for at least 25 percent of the

workers in each shift, or a minimum of 2, whichever is greater. Air monitoring results at the 95 percent confidence level shall be calculated as shown in Table 2 at the end of this section. The Contractor shall provide an independent testing laboratory with qualified analysts and appropriate equipment to conduct sample analyses of air samples using the methods prescribed in 29 CFR 1926, Section.1101, to include NIOSH 84-100 Method 7400. Preabatement and abatement environmental air monitoring shall be performed by the Contractor's Designated IH. Final clearance environmental air monitoring, shall be performed by the Contractor's Designated IH. Environmental and final clearance air monitoring shall be performed using NIOSH 84-100 Method 7400 (PCM) with optional confirmation of results by NIOSH 84-100 Method 7402 (TEM). For environmental and final clearance, air monitoring shall be conducted at a sufficient velocity and duration to establish the limit of detection of the method used at 0.005 f/cc. Confirmation of asbestos fiber concentrations (asbestos f/cc) from environmental and final clearance samples collected and analyzed by NIOSH 84-100 Method 7400 (total f/cc) may be conducted using TEM in accordance with NIOSH 84-100 Method 7402. When such confirmation is conducted, it shall be from the same sample filter used for the NIOSH 84-100 Method 7400 PCM analysis. For all Contractor required environmental or final clearance air monitoring, confirmation of asbestos fiber concentrations, using NIOSH 84-100 Method 7402, shall be at the Contractor's expense. Monitoring may be duplicated by the Government at the discretion of the Contracting Officer. Results of breathing zone samples shall be posted at the job site and made available to the Contracting Officer. The Contractor shall maintain a fiber concentration inside a regulated area less than or equal to 0.1 f/cc expressed as an 8 hour, time-weighted average (TWA) during the conduct of the asbestos abatement. If fiber concentration rises above 0.1 f/cc, work procedures shall be investigated with the Contracting Officer to determine the cause. At the discretion of the Contracting Officer, fiber concentration may exceed 0.1 f/cc but shall not exceed 1.0 f/cc expressed as an 8-hour TWA. The Contractor's workers shall not be exposed to an airborne fiber concentration in excess of 1.0 f/cc, as averaged over a sampling period of 30 minutes. Should either an environmental concentration of 1.0 f/cc expressed as an 8-hour TWA or a personal excursion concentration of 1.0 f/cc expressed as a 30-minute sample occur inside a regulated work area, the Contractor shall stop work immediately, notify the Contracting Officer, and implement additional engineering controls and work practice controls to reduce airborne fiber levels below prescribed limits in the work area. Work shall not restart until authorized by the Contracting Officer.

3.9.2 Initial Exposure Assessment

The Contractor's Designated IH shall conduct an exposure assessment immediately before or at the initiation of an asbestos abatement operation to ascertain expected exposures during that operation. The assessment shall be completed in time to comply with the requirements which are triggered by exposure data or the lack of a negative exposure assessment, and to provide information necessary to assure that all control systems planned are appropriate for that operation. The assessment shall take into consideration both the monitoring results and all observations, information or calculations which indicate employee exposure to asbestos, including any previous monitoring conducted in the workplace, or of the operations of the

Contractor which indicate the levels of airborne asbestos likely to be encountered on the job. For Class I asbestos work, until the employer conducts exposure monitoring and documents that employees on that job will not be exposed in excess of PELs, or otherwise makes a negative exposure assessment, the Contractor shall presume that employees are exposed in excess of the PEL-TWA and PEL-Excursion Limit.

3.9.3 Negative Exposure Assessment

The Contractor shall provide a negative exposure assessment for the specific asbestos job which will be performed. The negative exposure assessment shall be provided within 2 days of the initiation of the project and conform to the following criteria:

- a. Objective Data: Objective data demonstrating that the product or material containing asbestos minerals or the activity involving such product or material cannot release airborne fibers in concentrations exceeding the PEL-TWA and PEL-Excursion Limit under those work conditions having the greatest potential for releasing asbestos.
- b. Prior Asbestos Jobs: Where the Contractor has monitored prior asbestos jobs for the PEL and the PEL-Excursion Limit within 12 months of the current job, the monitoring and analysis were performed in compliance with asbestos standard in effect; the data were obtained during work operations conducted under workplace conditions closely resembling the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the Contractor's current operations; the operations were conducted by employees whose training and experience are no more extensive than that of employees performing the current job; and these data show that under the conditions prevailing and which will prevail in the current workplace, there is a high degree of certainty that the monitoring covered exposure from employee exposures will not exceed the PEL-TWA and PEL-Excursion Limit.
- c. Initial Exposure Monitoring: The results of initial exposure monitoring of the current job, made from breathing zone air samples that are representative of the 8-hour PEL-TWA and 30-minute short-term exposures of each employee. The monitoring covered exposure from operations which are most likely during the performance of the entire asbestos job to result in exposures over the PELs.

3.9.4 Preabatement Environmental Air Monitoring

Preabatement environmental air monitoring shall be established 1 day prior to the masking and sealing operations for each regulated area to determine background concentrations before abatement work begins. As a minimum, preabatement air samples shall be collected using NIOSH 84-100 Method 7400, PCM at these locations: outside the building; inside the building, but outside the regulated area perimeter; and inside each regulated work area. The PCM samples shall be analyzed within 24 hours; and if any result in

fiber concentration greater than 0.01 f/cc, asbestos fiber concentration shall be confirmed using NIOSH 84-100 Method 7402 (TEM).

3.9.5 Environmental Air Monitoring During Abatement

Until an exposure assessment is provided to the Contracting Officer, environmental air monitoring shall be conducted at locations and frequencies that will accurately characterize any evolving airborne asbestos fiber concentrations. The assessment shall demonstrate that the product or material containing asbestos minerals, or the abatement involving such product or material, cannot release airborne asbestos fibers in concentrations exceeding 0.01 f/cc as a TWA under those work conditions having the greatest potential for releasing asbestos. The monitoring shall be at least once per shift at locations including, but not limited to, close to the work inside a regulated area; outside entrances to a regulated area; close to glovebag operations; representative locations outside of the perimeter of a regulated area; inside clean room; and at the exhaust discharge point of local exhaust system ducted to the outside of a containment (if used). If the sampling outside regulated area shows airborne fiber levels have exceeded background or 0.01 f/cc, whichever is greater, work shall be stopped immediately, and the Contracting Officer notified. The condition causing the increase shall be corrected. Work shall not restart until authorized by the Contracting Officer.

3.9.6 Final Clearance Air Monitoring

Prior to conducting final clearance air monitoring, the Contractor and the Contracting Officer shall conduct a final visual inspection of the regulated area where asbestos abatement has been completed. The final visual inspection shall be as specified in SET-UP DETAIL SHEET 19. Final clearance air monitoring shall not begin until acceptance of the Contractor's final cleaning by the Contracting Officer. The Contractor's Designated IH shall conduct final clearance air monitoring using aggressive air sampling techniques as defined in EPA 560/5-85-024 or as otherwise required by federal or state requirements. The sampling and analytical method used will be NIOSH 84-100 Method 7400 (PCM).

3.9.6.1 Final Clearance Requirements, NIOSH PCM Method

For PCM sampling and analysis using NIOSH 84-100 Method 7400, the fiber concentration inside the abated regulated area, for each airborne sample, shall be less than 0.01 f/cc. The abatement inside the regulated area is considered complete when every PCM final clearance sample is below the clearance limit. If any sample result is greater than 0.01 total f/cc, the asbestos fiber concentration (asbestos f/cc) shall be confirmed from that same filter using NIOSH 84-100 Method 7402 (TEM) at Contractor's expense. If any confirmation sample result is greater than 0.01 asbestos f/cc, abatement is incomplete and cleaning shall be repeated. Upon completion of any required recleaning, resampling with results to meet the above clearance criteria shall be done.

3.9.6.2 Air Clearance Failure

If clearance sampling results fail to meet the final clearance

requirements, the Contractor shall pay all costs associated with the required recleaning, resampling, and analysis, until final clearance requirements are met.

3.9.7 Air-Monitoring Results and Documentation

Air sample fiber counting shall be completed and results provided within 24 hours (breathing zone samples), and 48 hours (environmental/clearance monitoring) after completion of a sampling period. The Contracting Officer shall be notified immediately of any airborne levels of asbestos fibers in excess of established requirements. Written sampling results shall be provided within 5 working days of the date of collection. The written results shall be signed by testing laboratory analyst, testing laboratory principal and the Contractor's Designated IH. The air sampling results shall be documented on a Contractor's daily air monitoring log. The daily air monitoring log shall contain the following information for each sample:

- a. Sampling and analytical method used;
- b. Date sample collected;
- c. Sample number;
- d. Sample type: BZ = Breathing Zone (Personal), P = Preabatement, E = Environmental, C = Abatement Clearance;
- e. Location/activity/name where sample collected;
- f. Sampling pump manufacturer, model and serial number, beginning flow rate, end flow rate, average flow rate (L/min);
- g. Calibration date, time, method, location, name of calibrator, signature;
- h. Sample period (start time, stop time, elapsed time (minutes));
- i. Total air volume sampled (liters);
- j. Sample results (f/cc and S/mm square) if EPA methods are required for final clearance;
- k. Laboratory name, location, analytical method, analyst, confidence level. In addition, the printed name and a signature and date block for the Industrial Hygienist who conducted the sampling and for the Industrial Hygienist who reviewed the daily air monitoring log verifying the accuracy of the information.

3.10 CLEARANCE CERTIFICATION

When asbestos abatement is complete, ACM waste is removed from the regulated areas, and final clean-up is completed, the Contracting Officer will certify the areas as safe before allowing the warning signs and boundary warning tape to be removed. The Contractor and the Contracting Officer shall visually inspect all surfaces within the containment for

residual material or accumulated debris. The Contractor shall reclean all areas showing dust or residual materials. The Contracting Officer will certify in writing that the area is safe before unrestricted entry is permitted. The Government will have the option to perform monitoring to certify the areas are safe before entry is permitted.

3.11 CLEANUP AND DISPOSAL

3.11.1 Title to ACM Materials

ACM material resulting from abatement work, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified and in accordance with applicable federal, state and local regulations.

3.11.2 Collection and Disposal of Asbestos

All ACM waste shall be collected and including contaminated wastewater filters, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing, shall be collected and placed in leak-tight containers such as double plastic bags (see DETAIL SHEET 9A); sealed double wrapped polyethylene sheet (see DETAIL 9B); sealed fiberboard boxes (see DETAIL SHEET 9C); or other approved containers. Waste within the containers shall be wetted in case the container is breached. Asbestos-containing waste shall be disposed of at an EPA, state and local approved asbestos landfill. For temporary storage, sealed impermeable containers shall be stored in an asbestos waste load-out unit or in a storage/transportation conveyance (i.e., dumpster, roll-off waste boxes, etc.) in a manner acceptable to and in an area assigned by the Contracting Officer. Procedure for hauling and disposal shall comply with 40 CFR 61, Subpart M, state, regional, and local standards.

3.11.3 Weigh Bill and Delivery Tickets

Copies of weigh bills and delivery tickets shall be submitted to the Contracting Officer during the progress of the work. The Contractor shall furnish the Contracting Officer scale tickets for each load of ACM weighed and certified. These tickets shall include tare weight; identification mark for each vehicle weighed; and date, time and location of loading and unloading. Tickets shall be furnished at the point and time individual trucks arrive at the worksite. A master log of all vehicle loading shall be furnished for each day of loading operations. Before the final statement is allowed, the Contractor shall file with the Contracting Officer certified weigh bills and/or certified tickets and manifests of all ACM actually disposed by the Contractor for this contract.

3.11.4 Asbestos Waste Shipment Record

The Contractor shall complete and provide the Contracting Officer final completed copies of the Waste Shipment Record for all shipments of waste material as specified in 40 CFR 61, Subpart M and other required state waste manifest shipment records, within 3 days of delivery to the landfill.

Each Waste Shipment Record shall be signed and dated by the Contractor, the waste transporter and disposal facility operator.

TABLE 1

INDIVIDUAL WORK TASK DATA ELEMENTS

Sheet 1 of 2

There is a separate data sheet for each individual work task.

1. WORK TASK DESIGNATION NUMBER 1
2. LOCATION OF WORK TASK Building 103
3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED: Thermal Pipe and Fitting Insulation
 - a. Type of Asbestos Amosite and Chrysotile
 - b. Percent asbestos content 10-45%
4. ABATEMENT TECHNIQUE TO BE USED REM
5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK Class I
6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK
Friable X Non-friable Category I _____
Non-friable Category II _____
7. FORM IA and CONDITION OF ACM: GOOD _____ FAIR X POOR _____
8. QUANTITY: METERS 156, SQUARE METERS _____
- 8a. QUANTITY: LINEAR FT. 510, SQUARE FT. _____
9. RESPONSE ACTION DETAIL SHEET NUMBER FOR WORK TASK 87
10. SET-UP DETAIL SHEET NUMBERS
FOR WORK TASK 1, 9A, 9B, 10, 11, 12, 13, 14,
15, 19, 20, 21, _____, _____.

NOTES:

- (1) Numeric sequence of individual work tasks (1,2,3,4, etc.) for each regulated area. Each category of EPA friability/OSHA class has a separate task.
- (2) Specific location of work (building, floor, area, e.g., Building 1421, 2nd Floor, Rm 201)
- (3) A description of material to be abated (example: horizontal pipe, cement wall panels, tile, stucco, etc.) type of asbestos (chrysotile, amosite, crocidolite, etc.); and % asbestos content.
- (4) Technique to be used: Removal = REM; Encapsulation = ENCAP; Encasement = ENCAS; Enclosure = ENCL; Repair = REP.
- (5) Class designation: Class I, II, III, or IV (OSHA designation).
- (6) Friability of materials: Check the applicable EPA NESHAP friability designation.
- (7) Form: Interior or Exterior Architectural = IA or EA; Mechanical/Electrical = ME.
Condition: Good = G; Fair = F; Poor = P.
- (8) Quantity of ACM for each work task in meters or square meters.
- (8a) Quantity of ACM for each work task in linear feet or square feet.
- (9) Response Action Detail Sheet specifies the material to be abated and the methods to be used. There is only one Response Action Detail Sheet for each abatement task.
- (10) Set-up Detail Sheets indicate containment and control methods used in support of the response action (referenced in the selected

TABLE 1

INDIVIDUAL WORK TASK DATA ELEMENTS
Response Action Detail Sheet).

TABLE 1

INDIVIDUAL WORK TASK DATA ELEMENTS

Sheet 2 of 2

There is a separate data sheet for each individual work task.

1. WORK TASK DESIGNATION NUMBER 1
2. LOCATION OF WORK TASK Building 103
3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED: Flexible Connector
 - a. Type of Asbestos Chrysotile
 - b. Percent asbestos content 35-50%
4. ABATEMENT TECHNIQUE TO BE USED REM
5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK Class II
6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK
Friable _____ Non-friable Category I _____
Non-friable Category II X
7. FORM IA and CONDITION OF ACM: GOOD X FAIR _____ POOR _____
8. QUANTITY: METERS _____, SQUARE METERS 1
- 8a. QUANTITY: LINEAR FT. _____, SQUARE FT. _____
9. RESPONSE ACTION DETAIL SHEET NUMBER FOR WORK TASK 45
10. SET-UP DETAIL SHEET NUMBERS
FOR WORK TASK 1, 9A, 9B, 11, 12, 13, 14, 15,
19, 20, 21, _____.

NOTES:

- (1) Numeric sequence of individual work tasks (1,2,3,4, etc.) for each regulated area. Each category of EPA friability/OSHA class has a separate task.
- (2) Specific location of work (building, floor, area, e.g., Building 1421, 2nd Floor, Rm 201)
- (3) A description of material to be abated (example: horizontal pipe, cement wall panels, tile, stucco, etc.) type of asbestos (chrysotile, amosite, crocidolite, etc.); and % asbestos content.
- (4) Technique to be used: Removal = REM; Encapsulation = ENCAP; Encasement = ENCAS; Enclosure = ENCL; Repair = REP.
- (5) Class designation: Class I, II, III, or IV (OSHA designation).
- (6) Friability of materials: Check the applicable EPA NESHAP friability designation.
- (7) Form: Interior or Exterior Architectural = IA or EA; Mechanical/Electrical = ME.
Condition: Good = G; Fair = F; Poor = P.
- (8) Quantity of ACM for each work task in meters or square meters.
- (8a) Quantity of ACM for each work task in linear feet or square feet.
- (9) Response Action Detail Sheet specifies the material to be abated and the methods to be used. There is only one Response Action Detail Sheet for each abatement task.
- (10) Set-up Detail Sheets indicate containment and control methods used in support of the response action (referenced in the selected Response Action Detail Sheet).

TABLE 1

INDIVIDUAL WORK TASK DATA ELEMENTS

TABLE 2

FORMULA FOR CALCULATION OF THE 95 PERCENT CONFIDENCE LEVEL
(Reference: NIOSH 7400)

$$\text{Fibers/cc(01.95 percent CL)} = X + (X) * (1.645) * (CV)$$

Where: $X = ((E)(AC))/((V)(1000))$

$$E = ((F/Nf) - (B/Nb))/Af$$

CV = The precision value; 0.45 shall be used unless the analytical laboratory provides the Contracting Officer with documentation (Round Robin Program participation and results) that the laboratory's precision is better.

AC = Effective collection area of the filter in square millimeters

V = Air volume sampled in liters

E = Fiber density on the filter in fibers per square millimeter

F/Nf = Total fiber count per graticule field

B/Nb = Mean field blank count per graticule field

Af = Graticule field area in square millimeters

$$\text{TWA} = C1/T1 + C2/T2 = Cn/Tn$$

Where: C = Concentration of contaminant

T = Time sampled.

TABLE 3

NIOSH METHOD 7400

PCM ENVIRONMENTAL AIR SAMPLING PROTOCOL (NON-PERSONAL)

Sample Location	Minimum No. of Samples	Filter Pore Size (Note 1)	Min. Vol. (Note 2) (Liters)	Sampling Rate (liters/min.)
Inside Abatement Area	0.5/140 Square Meters (Notes 3 & 4)	0.45 microns	3850	2-16
Each Room in 1 Abatement Area Less than 140 Square meters		0.45 microns	3850	2-16
Field Blank	2	0.45 microns	0	0
Laboratory Blank	1	0.45 microns	0	0

Notes:

1. Type of filter is Mixed Cellulose Ester.
2. Ensure detection limit for PCM analysis is established at 0.005 fibers/cc.
3. One sample shall be added for each additional 140 square meters. (The corresponding I-P units are 5/1500 square feet).
4. A minimum of 5 samples are to be taken per abatement area, plus 2 field blanks.

TABLE 4

EPA AHERA METHOD: TEM AIR SAMPLING PROTOCOL

Location Sampled	Minimum No. of Samples	Filter Pore Size	Min. Vol. (Liters)	Sampling Rate (liters/min.)
Inside Abatement Area	5	0.45 microns	1500	2-16
Outside Abatement Area	5	0.45 microns	1500	2-16
Field Blank	2	0.45 microns	0	0
Laboratory Blank	1	0.45 microns	0	0

Notes:

1. Type of filter is Mixed Cellulose Ester.
2. The detection limit for TEM analysis is 70 structures/square mm.

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME _____ CONTRACT NO. _____
PROJECT ADDRESS _____
CONTRACTOR FIRM NAME _____
EMPLOYEE'S NAME _____, _____, _____,
(Print) (Last) (First) (MI)

Social Security Number: _____-_____-_____,

WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH TYPES OF LUNG DISEASE AND CANCER. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NONSMOKING PUBLIC.

Your employer's contract for the above project requires that you be provided and you complete formal asbestos training specific to the type of work you will perform and project specific training; that you be supplied with proper personal protective equipment including a respirator, that you be trained in its use; and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment. These things are to be done at no cost to you. By signing this certification, you are acknowledging that your employer has met these obligations to you. The Contractor's Designated Industrial Hygienist will check the block(s) for the type of formal training you have completed. Review the checked blocks prior to signing this certification.

FORMAL TRAINING:

_____ a. For Competent Persons and Supervisors: I have completed EPA's Model Accreditation Program (MAP) training course, "Contractor/Supervisor", that meets this State's requirements.

b. For Workers:

_____ (1) For OSHA Class I work: I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

____ (2) For OSHA Class II work (where there will be abatement of more than one type of Class II materials, i.e., roofing, siding, floor tile, etc.): I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

(3) For OSHA Class II work (there will only be abatement of one type of Class II material):

(a) I have completed an 8-hour training class on the elements of 29 CFR 1926, Section .1101(k)(9)(viii), in addition to the specific work practices and engineering controls of 29 CFR 1926, Section .1101(g) and hands-on training.

_____ (b) I have completed EPA's MAP training course, "Worker",
that meets this State's requirements.

_____ (4) For OSHA Class III work: I have completed at least a 16-hour course consistent with EPA requirements for training of local education agency maintenance and custodial staff at 40 CFR 763, Section .92(a)(2) and

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

the elements of 29 CFR 1926, Section .1101(k)(9)(viii), in addition to the specific work practices and engineering controls at 29 CFR 1926, Section .1101, and hands-on training.

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

_____ (5) For OSHA Class IV work: I have completed at least a 2-hr course consistent with EPA requirements for training of local education agency maintenance and custodial staff at 40 CFR 763, (a)(1), and the elements of 29 CFR 1926, Section .1101(k)(9)(viii), in addition to the specific work practices and engineering controls at 29 CFR 1926, Section .1101(g) and hands-on training.

_____ c. Workers, Supervisors and the Designated Competent Person: I have completed annual refresher training as required by EPA's MAP that meets this State's requirements.

PROJECT SPECIFIC TRAINING:

_____ I have been provided and have completed the project specific training required by this Contract. My employer's Designated Industrial Hygienist and Designated Competent Person conducted the training.

RESPIRATORY PROTECTION:

_____ I have been trained in accordance with the criteria in the Contractor's Respiratory Protection program. I have been trained in the dangers of handling and breathing asbestos dust and in the proper work procedures and use and limitations of the respirator(s) I will wear. I have been trained in and will abide by the facial hair and contact lens use policy of my employer.

RESPIRATOR FIT-TEST TRAINING:

_____ I have been trained in the proper selection, fit, use, care, cleaning, maintenance, and storage of the respirator(s) that I will wear. I have been fit-tested in accordance with the criteria in the Contractor's Respiratory Program and have received a satisfactory fit. I have been assigned my individual respirator. I have been taught how to properly perform positive and negative pressure fit-check upon donning negative pressure respirators each time.

MEDICAL EXAMINATION:

_____ I have had a medical examination within the last twelve months which was paid for by my employer. The examination included: health history, pulmonary function tests, and may have included an evaluation of a chest x-ray. A physician made a determination regarding my physical capacity to perform work tasks on the project while wearing personal protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. My employer's Industrial Hygienist evaluated the medical certification provided by the physician and checked the appropriate blank below. The physician determined that there:

_____ were no limitations to performing the required work tasks.

_____ were identified physical limitations to performing the required work tasks.

Date of the medical examination _____

Employee Signature _____ date _____

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

Contractor's Industrial

Hygienist Signature _____ date _____

-- End of Section --

July 2004

102396

**HAZARDOUS MATERIAL
INVESTIGATION REPORT
FOR
BUILDING 103
THULE AIR BASE, GREENLAND**



Prepared by

Baker

Baker and Associates, Inc.
Moon Township, Pennsylvania

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EXECUTIVE SUMMARY

Introduction

Baker and Associates, Inc. (Baker) conducted an environmental study at Building 103 located at the Thule Air Base (AB), Greenland, during March 17 through 23, 2004. The environmental study required an asbestos-containing materials (ACM) investigation and sampling, limited lead-containing paint investigation and sampling, suspected polychlorinatedbiphenyls (PCBs) material documentation, and general safety hazard documentation within the selected building.

Mr. Gary Case of Baker conducted this field investigation and inspection. Mr. Case is an EPA-certified Building Inspector, Management Planner, and Project Designer for asbestos and an EPA-certified Inspector and Risk Assessor for lead paint. Baker's office is located at 100 Airside Drive, Moon Township, Pennsylvania, 15108, telephone number 412-269-6300, and fax number 412-375-3996.

The inspection involved the identification of suspect homogeneous building materials and paint, sampling and laboratory analysis, and an assessment of the conditions and location of the suspected building materials and paint, as well as other hazards. Laboratory analysis of the bulk material and paint samples was conducted by EMSL Analytical, Inc. of Westmont, New Jersey.

Regulatory Background

The United States Environmental Protection Agency (USEPA) and Federal Occupational Safety and Health Administration (OSHA) define asbestos-containing material (ACM) as any material that contains greater than one percent asbestos. Title 40 of the Code of Federal Regulations, Part 61 (40 CFR 61), Subpart M (USEPA National Emission Standards for Hazardous Air Pollutants) requires that an asbestos inspection be conducted prior to renovation/demolition activities.

OSHA defines lead-containing paint (LCP) as a paint that contains any amount of lead within the paint. OSHA mandates that employers monitor their employee's exposure to lead whenever products coated with lead-containing paint (as well as other lead-containing materials) are impacted, demolished, and/or removed.

Summary of Findings and Recommendations

The purpose of this environmental study was to identify hazardous materials (asbestos, lead-containing paint, etc.) prior to demolition of Building 103 at Thule Air Base, so that proper procedures can be utilized to prevent creation of any potential hazards. This survey was conducted in support of the initial concept demolition design for this building; thus, it is assumed that all of the materials identified in this survey will have to be removed to accomplish the project.

The following chart provides details on the identified concerns within the building.

ACM Concern	LCP Concern	PCB Concern	Hazardous Building Debris Concern	Other Hazards Concern
Yes	Yes	No	No	No

Asbestos

Based upon the review of the results of this investigation, this building contains building components that can be classified as ACM (see Table 1). The ACM within the surveyed areas can be currently managed in-place with little potential hazard. However, due to the proposed project, all of the ACM that will be impacted or disturbed should be properly handled or removed, and if removed, disposed of accordingly. The selected contractor should be responsible for the safe and proper handling of the asbestos-containing items according to all federal, state, and local regulations. The contractor should comply with the OSHA standards, which regulates occupational exposure to asbestos.

Lead-Containing Paint

Based upon the results of this investigation and the age of the building, the building contains some individual building components that can be classified as being coated with LCP (see Table 2). The selected contractor should be responsible for the safe and proper handling of the painted items according to all federal, state, and local regulations. The contractor should comply with the OSHA lead standard, which regulates occupational exposure to lead.

Toxicity Characteristic Leaching Procedure (TCLP)

Based upon the result of the TCLP sample, the painted building components should not produce construction debris that would need to be reported and handled as a hazardous waste (see Table 3).

PCB

Based upon the results of this investigation and records review, this building does not exhibited a problem with any PCB-containing equipment.

Other Hazards

Based upon the results of this investigation, this building contains equipment and several other useable chemical products. The Base officials stated that all equipment and chemical products will be removed prior to the demolition. Thus, no additional hazards need to be corrected prior to the demolition based upon this investigation.

Disclaimer

The information that is presented in this report reflects the conditions that were observed in the building during the time frame this inspection was conducted. However, conditions could change due to vandalism, deterioration, or maintenance activities. Although every effort was made to identify all potential suspect building materials and components, there is no guarantee that additional materials are not present. Conditions may exist in the building, such that inaccessible materials may only become apparent during demolition activities.

1.0 INTRODUCTION

Baker and Associates, Inc. (Baker) conducted an environmental study at Building 103 located at the Thule Air Base (AB), Greenland, during March 17 through 23, 2004. The environmental study required an asbestos-containing materials (ACM) investigation and sampling, limited lead-containing paint investigation and sampling, suspected polychlorinated biphenyls (PCBs) material documentation, and general safety hazard documentation within the selected building.

This report summarizes the activities and procedures used during the project, and presents the survey findings and recommendations. The text of this report is supplemented by information found within Appendices A through D. Appendix A contains copies of training certificates for the staff who conducted the investigation and the certificates of accreditation for the laboratories that conducted sample analysis. Appendix B contains sample location sketch of the building. Appendix C contains laboratory analytical reports for bulk material and paint samples. Appendix D contains the photographs pertinent to the inspection of this building.

2.0 INSPECTION PROCEDURES

2.1 General

Mr. Gary Case of Baker conducted this field investigation and inspection of this building. Mr. Case is an EPA-certified Building Inspector, Management Planner, and Project Designer for asbestos and an EPA-certified Inspector and Risk Assessor for lead paint. Copies of his training certificates are included in Appendix A.

Baker utilized EMSL Analytical, Inc. of Westmont, New Jersey for laboratory analysis of collected samples. The laboratory is accredited in accordance with standards set by the U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP), and by the American Industrial Hygiene Association (AIHA) for both asbestos and lead analysis. Copies of their certifications are included in Appendix A.

2.2 Survey

Baker conducted the survey of Building 103 on March 17 through 23, 2004. Within this building, the inspector conducted a thorough search to identify potential asbestos-containing building materials, lead-containing paint, and other hazards. When a suspected material or paint was located, the bulk material sampling plan or paint screening plan was implemented. Under these plans, suspect building materials or paint were grouped into homogeneous sampling areas, which contained materials that were uniform in texture, appearance, color, physical characteristics, and function. For asbestos, each homogeneous material was given a unique identification number. Once the homogeneous material boundaries were established, core samples of the material were collected. Insulation materials that appeared to be composed of fiberglass were not considered potential (i.e., suspect) ACM. Material condition of each asbestos material was assessed as described in the chart below.

MATERIAL CONDITION DESCRIPTIONS

Condition	Description
No Damage	Material is intact
Damaged	Less than 10% distributed damage, or less than 25% localized damage
Significant Damage	10% or more distributed damage, or 25% or more localized damage

For each suspect homogeneous material, the material description, location(s), approximate quantity of asbestos, friability, condition, sample identification, sample location, and sample result information were recorded on the field data forms. The definition of a friable material is one that can be crushed, pulverized, or reduced to powder under hand pressure when dry. The definition of a non-friable material is one that cannot be crushed, pulverized, or reduced to powder under hand pressure when dry. Sample locations were noted on a sample location sketch for the building. The field sketch is included in Appendix B.

Samples were collected by using chisels, utility knives, etc. to remove small pieces of building materials. Each sample was placed into a re-sealable plastic bag and given a unique sample identification number. During sampling activities, the inspector exercised care to prevent any suspected ACM from becoming airborne. Wet wiping was used during the sampling to immediately clean up any debris generated by the sampling process.

The LCP inspection was limited to the painted structural building components that might be impacted during the demolition. For this building, testing combinations, paint colors, paint conditions, location(s), and notes were recorded on data forms. The condition categories and associated descriptions are described in the following chart.

PAINT CONDITION DESCRIPTIONS

Condition	Description
Intact	Paint is not deteriorated
Fair	Paint has some deterioration: ≤ 2 square feet for large components (e.g., walls and ceilings) ≤ 10 percent for small components (e.g., baseboards, window casings, etc.).
Poor	Paint has significant deterioration: > 2 square feet for large interior components > 10 percent for small components.

Baker collected a composite sample of all of the painted building components from this building. This sample was obtained for the purpose of characterizing the waste debris that will be generated during the demolition activities with respect to lead paint disposal requirements (i.e., hazardous or non-hazardous). The components selected for inclusion in the composite sample were based on those items that have been designated for removal during the planned demolition project. The percentage of the building components within the total sample was roughly based on the estimated percentage of weight that the components will represent in the total weight of the building debris. However, in order to be conservative, slightly higher percentages of the lead-containing paint containing components were included in the sample than what may likely be in the actual debris. The composite sample also was sent to EMSL Analytical, Inc. for lead analysis using the toxicity characteristic leaching procedure.

2.3 Inspection for Other Hazards

Baker visually inspected the building for evidence of mold and animal excrement concurrently with the asbestos survey. Baker also documented any safety, chemical, and/or physical concerns observed at the building.

3.0 SUMMARY OF FINDINGS

3.1 Asbestos

As part of the investigation, Baker identified and collected bulk material samples for 7 suspected homogeneous materials that were present and suspected to be asbestos-containing for this building. Only 4 of the sampled materials were reported to be ACM. The laboratory analyses indicated that the remaining homogeneous materials contained no detectable asbestos. A summary of the ACM for this building is presented in Table 1. The locations of the samples can be found on the sample location sketch which can be found in Appendix B. The laboratory analytical report for this building is contained in Appendix C.

3.2 Lead Paint

Baker collected a total of 4 bulk paint chips for this building. OSHA defines LCP as paint that contains any amount of lead by laboratory analysis. All of the paint identified were LCP. A summary of the LCP results for this building is presented in Table 2. The locations of the samples can be found on the sample location sketch which can be found in Appendix B. The laboratory analytical report for this building is contained in Appendix C.

3.3 TCLP

The anticipated waste stream for this building was characterized for leachable lead through a TCLP analysis. According to the EPA, the TCLP criteria limit for leachable lead is 5 milligrams per liter (mg/L). The TCLP result for this building did not exceed the criteria limit for leachable lead. The result of the TCLP analysis is summarized in Table 3. The laboratory analytical report is contained in Appendix C.

3.4 Other Hazards

An investigation for evidence of mold, animal excrement, other hazardous materials, safety issues, and other hazards was conducted in this building. Several chemical products containers were identified

throughout the building. No spills were documented within the building. According to information provided by the Base officials at the time of the investigation, none of the chemical products were considered as a hazard, especially since the products are to be removed prior to the demolition of the building. Thus, no hazards were recorded for the building.

4.0 RECOMMENDATIONS

The purpose of this environmental study was to identify hazardous materials (asbestos, lead-containing paint, etc.) prior to the demolition of this selected building at Thule AB, so that proper procedures can be utilized to prevent creation of any potential hazards. This survey was conducted in support of the initial concept demolition design for this building, thus, it is assumed that all of the materials identified in this survey will have to be removed to accomplish the project.

4.1 Asbestos

Based upon the review of the results of this investigation, the building contains several building components that can be classified as ACM (see Table 1). While there are several ACM that are currently damaged, they can be managed in-place with little potential hazard once repaired. However, due to the proposed project, all of the ACM that will be impacted or disturbed should be properly handled or removed, and if removed, disposed of accordingly. Abatement plans should be designed in accordance with EPA and other federal, state, and local regulations and/or using appropriate guidelines by a certified Asbestos Designer and reviewed by a Certified Industrial Hygienist. All abatement activities should be overseen and managed by an experienced Asbestos Abatement Supervisor. Removal notifications, activities, and disposal must be completed in accordance with EPA and other applicable federal, state, and local regulations.

4.2 Lead-Containing Paint

Based upon the results of this investigation and the age of the building, the building contained some individual building components that can be classified as being coated with LCP (see Table 2). Several locations within the building have areas of damaged or deteriorated paint. The damaged paint should be repaired if the building is to remain or become occupied. If the building is demolished, the selected contractor should be responsible for the safe and proper handling of the painted items according to all federal, state, and local regulations. The contractor should comply with the OSHA lead standard, which regulates occupational exposure to lead.

4.3 Toxicity Characteristic Leaching Procedure (TCLP)

Based upon the result of the TCLP sample, the painted building components should not produce construction debris that would need to be reported and handled as a hazardous waste (see Table 3).

4.4 Other Hazards

Based upon the results of this investigation, there are no other hazards to report.

5.0 LIMITATIONS OF THE INSPECTION

The information that is presented in this report reflects the conditions that were observed in the building during the time frame that this inspection was conducted. Although every effort was made to identify all of the potential suspect building materials, there is no guarantee that additional materials are not present. Conditions may exist such that inaccessible materials may only become apparent during renovation or demolition activities. If suspect building materials are identified during renovation or demolition activities, they should be sampled and analyzed prior to disturbance. If warranted, the material should be removed and handled according to all applicable EPA, OSHA, state, and local regulations.

TABLE 1
SUMMARY OF ASBESTOS-CONTAINING MATERIALS

BUILDING 103
THULE AB

Homogeneous Material Number	Material Type	Material Description	Material Locations	Friable	Sample Numbers	Sample Results	Sample Locations	Asbestos-Containing Material	Approximate Quantity of Asbestos	Condition of Asbestos
001	Thermal Pipe and Fitting Insulation	3" thick, white	Storage Bays 2, 4, 5, and 6, Mechanical Room, and Toilet	Yes	0304-103-001A 0304-103-001B 0304-103-001C	10% AM, 35% CH 20% AM, 25% CH 15% AM, 40% CH	Bay 2 Bay 6 Mechanical	Yes	160 linear feet 49 linear meters	Damaged
002	Thermal Pipe and Fitting Insulation	4" thick, white	Storage Bays 1, 2, 3, 4, 5, and 6, Mechanical Room, and Toilet	Yes	0304-103-002A 0304-103-002B 0304-103-002C	35% AM, 25% CH 45% AM, 30% CH 45% AM, 35% CH	Bay 1 Bay 5 Mechanical	Yes	275 linear feet 84 linear meters	Damaged
003	Thermal Pipe and Fitting Insulation	5" thick, white	Storage Bays 1, 2, 3, 4, 5, and 6, Mechanical Room, and Toilet	Yes	0304-103-003A 0304-103-003B 0304-103-003C	35% AM, 40% CH 45% AM, 40% CH 30% AM, 35% CH	Bay 3 Bay 4 Mechanical	Yes	75 linear feet 23 linear meters	Damaged
004	Sheetrock / Joint Compound	White	Office in Storage Bay 1	No	0304-103-004A 0304-103-004B 0304-103-004C	None Detected None Detected None Detected	Office Office Office	No	Not Applicable	Not Applicable
005	Flexible Connector	Gray	Mechanical Room	No	0304-103-005A 0304-103-005B 0304-103-005C	50% CH 35% CH 40% CH	Mechanical Mechanical Mechanical	Yes	1 Each	No Damage
006	Asphaltic Roofing Materials	Main Roof Tar and Felt	Roof	No	0304-103-006A 0304-103-006B 0304-103-006C	None Detected None Detected None Detected	Roof Roof Roof	No	Not Applicable	Not Applicable
007	Wall Insulation	White	Entire Building	Yes	0304-103-007A 0304-103-007B 0304-103-007C	None Detected None Detected None Detected	Bay 3 Bay 5 Mechanical	No	Not Applicable	Not Applicable

According to EPA, asbestos-containing material (ACM) is defined as any material containing greater than one percent (1%) asbestos using laboratory analysis.

AM = Amosite
CH = Chrysotile

TABLE 2
SUMMARY OF PAINT SAMPLE RESULTS

BUILDING 103
THULE AB

Paint	Description	Location of Paint	Sample Numbers	Location of Sample	Lead Concentration (% Pb by weight)	Comments
1	Blue Paint	Mechanical Room, Toilet, and Entry	0304-103-P001	Mechanical Room	4.20	This paint is lead-containing. The quantity of lead within sample shows high level of lead.
2	Gray Paint	Storage Bays 1 - 6	0304-103-P002	Bay 2	0.94	This paint is lead-containing. The quantity of lead within sample shows moderate level of lead.
3	Yellow/Red Paint, on Columns	Storage Bays 1 - 6	0304-103-P003	Bay 3	2.90	This paint is lead-containing. The quantity of lead within sample shows high level of lead.
4	Green Paint	Exterior on Garage Doors and Ends of Building	0304-103-P004	Garage Door for Bay 1	3.50	This paint is lead-containing. The quantity of lead within sample shows high level of lead.

According to OSHA, lead-containing paint (LCP) is defined as any paint containing any amount of lead concentration within the paint, using laboratory analysis.

TABLE 3
SUMMARY OF TCLP RESULT

BUILDING 103
THULE AB

Number of Samples Taken	Sample Numbers	TCLP Lead Concentration (mg/L)	Comments
1	0304-103-TCLP	< 0.4	-----

According to the EPA, TCLP criteria limit for leachable lead is defined as 5 milligrams per liter (mg/L) using laboratory analysis.

Training Certificates and Certificates of Accreditation

Professional Training Associates, Inc.

ASBESTOS BUILDING INSPECTOR Refresher Training Course

Gary R. Case

has successfully completed the Asbestos Building Inspector Refresher Course and passed the course examination for purposes of accreditation under Section 206 of Title II of the Toxic Substance Control Act (TSCA). Conducted by Professional Training Associates, Inc., 46 South Linden Street, Suite C, Duquesne, PA 15110, (412) 460-0266.

CASEGAR
BIR050604DUQUESN

Location: Duquesne, PA

Examination: May 6, 2004

Course Date: May 6, 2004

Expiration: May 6, 2005

Course Director:


John J. Curcio

Certificate Number: PTA 04- 23 -14208

Professional Training Associates, Inc.

ASBESTOS MANAGEMENT PLANNER

Refresher Training Course

Gary R. Case

has successfully completed the Asbestos Management Planner Refresher Course and passed the course examination for purposes of accreditation under section 206 of Title II of the Toxic Substance Control Act (TSCA). Conducted by Professional Training Associates, Inc., 46 South Linden Street, Suite C, Duquesne, PA 15110, (412) 460-0266.

CASEGAR
MPR050604DUQUESN

Location: Duquesne, PA

Examination: May 6, 2004

Course Date: May 6, 2004

Expiration: May 6, 2005

Course Director:


John J. Curcio

Certificate Number: PTA 04- 24 -14220

Professional Training Associates, Inc.

ASBESTOS PROJECT DESIGNER Refresher Training Course

Gary R. Case

has successfully completed the Asbestos Project Designer Refresher Course and passed the course examination for purposes of accreditation under section 206 of Title II of the Toxic Substance Control Act (TSCA). Conducted by Professional Training Associates, Inc., 46 South Linden Street, Suite C, Duquesne, PA 15110, (412) 460-0266.

CASEGAR
PDR050704DUQUESN

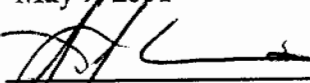
Location: **Duquesne, PA**

Examination: **May 7, 2004**

Course Date: **May 7, 2004**

Expiration: **May 7, 2005**

Course Director:


John J. Curcio

Certificate Number: **PTA 04- 25 -14227**

Professional Training Associates, Inc.

LEAD INSPECTOR Initial Training Course

Gary R. Case

P.O. Box 26, Main Sreet
Seminole, PA 16253

has successfully completed the Lead Inspector Initial Training Course and passed the examination for the purpose of accreditation under Act 44 PA. Code, Chapter 203, Lead Occupation Accreditation and Certification. Conducted by Professional Training Associates, Inc., 46 South Linden Street, Suite C, Duquesne, PA 15110, (412) 460-0266. Expiration date contingent upon passing State examination within 6-months of course date below.

CASEGAR
LI#042202DUQUESN

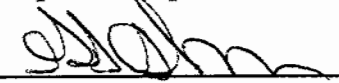
Location: **Duquesne, PA**

Examination: **April 24, 2002**

Course date: **April 22 - April 24, 2002**

Expiration: **April 24, 2005**

Course Director:


Gregory S. Ashman

Certificate Number: **PTA 02 - 32 - 9432**

Professional Training Associates, Inc.

LEAD RISK ASSESSOR Initial Training Course

Gary R. Case

P.O. Box 26, Main Sreet
Seminole, PA 16253

has successfully completed the Lead Risk Assessor Initial Training Course and passed the examination for the purpose of accreditation under Act 44 PA. Code, Chapter 203, "Lead Occupation Accreditation and Certification". Conducted by Professional Training Associates, Inc., 46 South Linden Street, Suite C, Duquesne, PA 15110, (412) 460-0266. Expiration date contingent upon passing State examination within 6-months of course date below.

CASEGAR
LA1042502DUQUESN

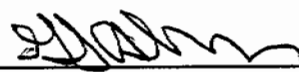
Location: Duquesne, PA

Examination: April 26, 2002

Course date: April 25 - April 26, 2002

Expiration: April 26, 2005

Course Director:


Gregory S. Ashman

Certificate Number: PTA 02 -33 -9444

Lab details

Advanced Search [Search](#)[Home](#)[Services](#) ▶[Lab Locations](#)[Qualifications](#) ▶[News](#)[Event Calendar](#) ▶[Sampling Guides](#)[Product Catalog](#)[Chain Of Custody](#)[Forms](#)[Resources](#) ▶[About EMSL](#) ▶[Contact Us](#)[LABConnect™](#) ▶

Westmont, NJ

107 Haddon Avenue , Westmont, NJ, 08108
 Phone: (856) 858-4800 Fax: (856) 858-4960 (856) 427-1608
 Email: jfrasca@emsl.com
[Click here for map/directions \(courtesy Yahoo maps\)](#)

The Westmont Lab is the World Headquarters for EMSL.

Services carried out by this Laboratory (click for details)

Asbestos Lab Services

Chain of C

Environmental Chemistry Lab Services

Chain of C

Environmental Microbiology Lab Services

Chain of C

Indoor Air Quality Lab Services

Chain of C

Industrial Hygiene Lab Services

Chain of C

Lead Lab Services

Chain of C

Materials Testing, Characterization & Forensic Lab Services

Chain of C

Other services provided by EMSL

List of Qualifications (click for details)

ELLAP

100194

EMLAP

100194

IHLAP

100194

ELPAT - Paint Chips, Soil, Dust Wipes, Air

100194

EMPAT - Bacteria and Fungi

100194

IHPAT - Asbestos, Metals, Silica, Organics and 3M Diffusive Sampler

100194

NVLAP - Air and Bulk

101048-0

USDA - Soil Permit

S-50747

AL - Lead and Asbestos 100.1 and 100.2

41260

AZ - Air and Bulk Asbestos

AZ0909

CA - Lead

1877

CA - Bulk Asbestos and Microbiology

2492

CT - PCM, PLM and TEM

PH-0566

CT - Paint Chips, Dust Wipes, Soil, Inorganic and Organic Chemicals

PH-0270

FL - Asbestos in Drinking Water - 100.1 and 100.2

E87788

FL - Lead

E87786

GA - Asbestos in Drinking Water

964

HI - Bulk Asbestos

L-01-032

IN - Lead and Asb. in D. Water - 100.1

C-NJ-02

KY - Chemistry - Drinking Water

90123

LA - Lead

04047

ME - Air Asbestos Analysis

LA-0038

ME - Bulk Asbestos Analysis

LB-0039

MD - Lead

297

MA - Chemistry and Asbestos in D.W. 100.2

M-NJ337

MA - PCM, PLM and TEM

AA000056

MT - Asbestos 100.1 & 100. 2 and Lead

CERT0011

NH - Lead - Drinking Water

252003

NJ - Chemistry

04653

NJ - Asbestos and Microbiology

04006

NY - ELAP - Air and Emissions - Particulates and TSP

10872

NY - ELAP - Chemistry

10896

NY - ELAP - Air and Emissions - Asbestos

10872

NY - ELAP - Potable Water - 100.1 and 100.2

10872

NY - ELAP - Solid and Hazardous Waste

10872

NC - Copper and Lead

34700

OH - Lead

10002

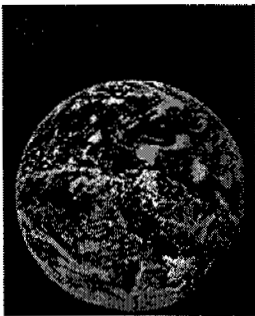
PA - Lead - Drinking Water

68-367

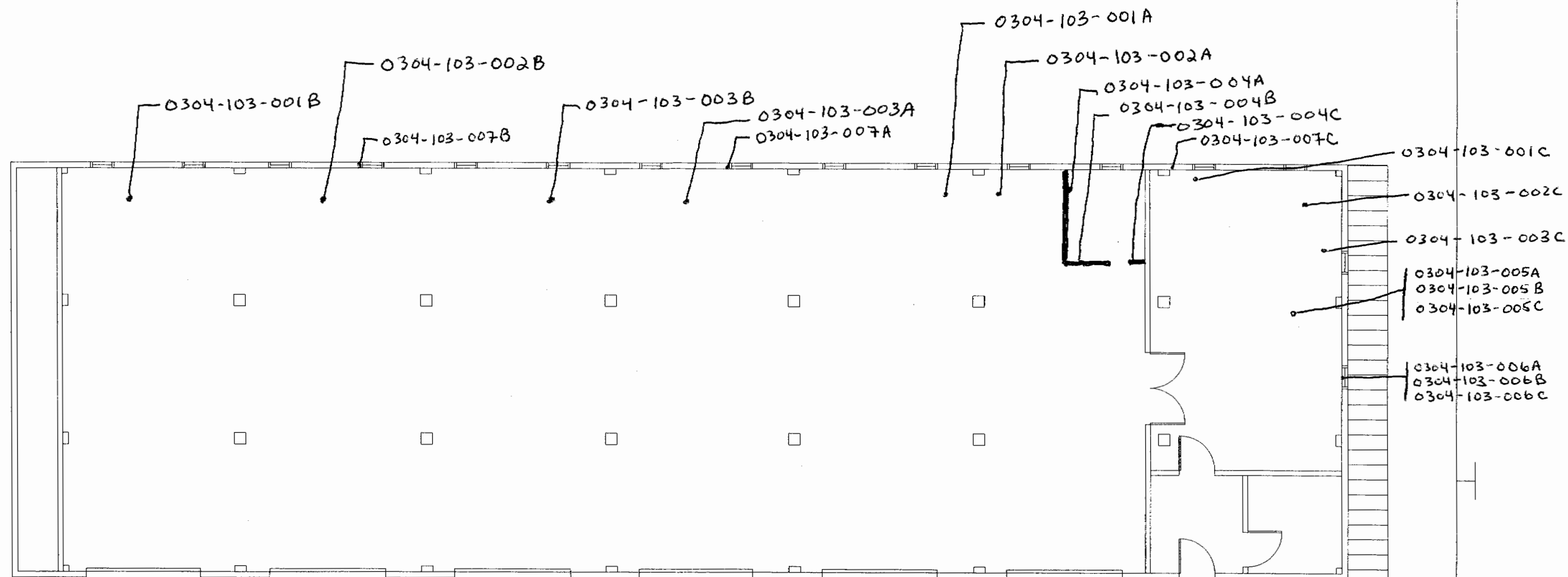
PA - Asbestos in Drinking Water	68-581
PA - PCM, PLM and TEM	137
RI - PCM, PLM and TEM	AAL-075T
RI - Air, Bulk, Dust, NPW and PW	00278
RI - Chemistry	129
SC - Asbestos	94017001
SC - WPP and SDWA	94014001
SC - SHW	94014002
TN - Asbestos in Drinking Water	02856
TX - PCM, PLM and TEM	30-0161
TX - Lead and Asb. in DW 100.1 & 100.2	TX242-201
VT - PCM, PLM and TEM	AL015617
VT - Lead	LL015548
VA - PCM, PLM and TEM	3333 0000
VA - Lead and Asb. in D. W. 100.1 & 100.2	00103
WV - Air and Bulk Asbestos	LT000199

Instrumentation used at this Lab ([click for details](#))

Auger Electron Spectroscope (AES)
 Cryo-Microtome
 Energy Dispersive X-Ray Analyzer (EDXA)
 Flame Atomic Absorption (FAA)
 Fourier Transform Infrared Microscope (micro-FTIR)
 Fourier Transform Infrared Spectrometer (FTIR)
 Gas Chromatograph (GC)
 Gas Chromatograph/Electron Capture Detector
 Gas Chromatograph/Flame Ionization
 Gas Chromatograph/Flame Photometric Detector
 Gas Chromatograph/Hall-PID Detectors
 Gas Chromatograph/Mass Spectrometer (GC/MS)
 Gas Chromatograph/Microbial ID System
 Gas Chromatograph/Nitrogen Phosphorus Detector
 Gas Chromatograph/Thermal Conductivity Detector
 Graphite Furnace Atomic Absorption (GFAA)
 High Performance Liquid Chromatography/Diode Array/Fluorescence Detectors
 Inductively Coupled Plasma Spectrometer (ICP)
 Near Infrared Spectroscopy (NIR)
 Phase Contrast Microscope (PCM)
 Polarized Light Microscope (PLM)
 Precision Ion Polishing System (PIPS)
 Real Time PCR (Real-Time Polymerase Chain Reaction)
 Scanning Electron Microscope (SEM)
 Tinius Olson Impact Tester
 Transmission Electron Microscope (TEM)
 X-Ray Diffractometer (XRD)
 X-ray Fluorescence Spectrometer (WD-XRF)



Sample Location Sketch



1 ENVIRONMENTAL
H-101H-10 SCALE: 1 : 50

Revision	Description	Date	Approved
Baker <small>3601 Eisenhower Avenue Suite 501 Alexandria, Virginia 22304 (703) 960-4400</small> Baker and Associates <small>a part of Baker Don Corporation</small>		U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS NEW YORK, NEW YORK	
Designed by: NN Drawn by: NN Checked by: NN Submitted by:		FY-'05 DORMITORY REPLACEMENT THULE AIR BASE, GREENLAND	
ARCHITECT: ENGINEER		BUILDING 103	
Reviewed by:	Approval Recommended:	Sheet reference number:	Date: 05-10-04
SECTION CHIEF	CHEF, ENGINEERING DIVISION	H-101	Scale: AS NOTED
Concurred:	Approved by:		Sheet: XX of 40
CHIEF, DESIGN BRANCH	CORPORAL, C.E. DISTRICT ENGINEER		

FILE NO. XX

Laboratory Analytical Reports

Baker

Laboratory Report for Asbestos

EMSL Analytical, Inc.

107 Haddon Ave., Westmont, NJ 08108

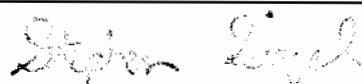
Phone: (856) 858-4800 Fax: (856) 858-4960 Email: ssiegel@EMSL.com

EMSLAttn: Gary Case
Baker Environmental
100 Airside Drive
Moon Township, PA 15108Fax: (412) 375-3996
Project: 102396 Tasl 00001

Phone: (412) 269-6381

Customer ID: BAKE51
Customer PO:
Received: 04/08/04 10:55 AM
EMSL Order: 040406199
EMSL Proj:
Analysis Date: 4/14/04**Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy**

Sample	Location	Appearance	Treatment	Non-Asbestos		Asbestos
				% Fibrous	% Non-Fibrous	% Type
0304-103-001A 040406199-0001		White Fibrous Homogeneous	Teased	40% Cellulose	20% Non-fibrous (other)	10% Amosite 30% Chrysotile
0304-103-001B 040406199-0002		White Fibrous Homogeneous	Teased	35% Cellulose	20% Non-fibrous (other)	20% Amosite 25% Chrysotile
0304-103-001C 040406199-0003		White Fibrous Homogeneous	Teased	35% Cellulose	10% Non-fibrous (other)	15% Amosite 40% Chrysotile
0304-103-002A 040406199-0004		White Fibrous Homogeneous	Teased	35% Cellulose	5% Non-fibrous (other)	35% Amosite 25% Chrysotile
0304-103-002B 040406199-0005		White Fibrous Homogeneous	Teased	20% Cellulose	5% Non-fibrous (other)	45% Amosite 30% Chrysotile
0304-103-002C 040406199-0006		White Fibrous Homogeneous	Teased	15% Cellulose	5% Non-fibrous (other)	45% Amosite 35% Chrysotile
0304-103-003A 040406199-0007		White Fibrous Homogeneous	Teased	15% Cellulose	10% Non-fibrous (other)	35% Amosite 40% Chrysotile
0304-103-003B 040406199-0008		White Fibrous Homogeneous	Teased	10% Cellulose	5% Non-fibrous (other)	45% Amosite 40% Chrysotile
0304-103-003C 040406199-0009		Gray/White Fibrous Heterogeneous	Teased	20% Cellulose	15% Non-fibrous (other)	30% Amosite 35% Chrysotile



Analyst(s)

Wayne Froehlich (21)

Stephen Siegel, CIH
or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. The test results contained within this report meet the requirements of NELAC unless otherwise noted.

Analysis performed by EMSL Westmont (NVLAP #101048-0), NY ELAP 10872

EMSL Analytical, Inc.

107 Haddon Ave., Westmont, NJ 08108

Phone: (856) 858-4800 Fax: (856) 858-4960 Email: ssiegel@EMSL.com

Attn: Gary Case
Baker Environmental
100 Airside Drive
Moon Township, PA 15108

Fax: (412) 375-3996

Phone: (412) 269-6381

Project: 102396 Tasi 00001

Customer ID: BAKE51

Customer PO:

Received: 04/08/04 10:55 AM

EMSL Order: 040406199

EMSL Proj:

Analysis Date: 4/14/04

Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Treatment	Non-Asbestos		Asbestos
				% Fibrous	% Non-Fibrous	% Type
0304-103-004A 040406199-0010		Gray/Tan Fibrous Heterogeneous	Crushed	10% Cellulose	90% Non-fibrous (other)	None Detected
0304-103-004B 040406199-0011		Gray/Tan Fibrous Heterogeneous	Crushed	15% Cellulose	85% Non-fibrous (other)	None Detected
0304-103-004C 040406199-0012		Gray/Tan Fibrous Heterogeneous	Crushed	15% Cellulose	85% Non-fibrous (other)	None Detected
0304-103-005A 040406199-0013		White Fibrous Homogeneous	Teased	50% Cellulose		50% Chrysotile
0304-103-005B 040406199-0014		White Fibrous Homogeneous	Teased	65% Cellulose		35% Chrysotile
0304-103-005C 040406199-0015		White Fibrous Homogeneous	Teased	60% Cellulose		40% Chrysotile
0304-103-006A 040406199-0016		Black Fibrous Heterogeneous	Teased	70% Cellulose	30% Non-fibrous (other)	None Detected
0304-103-006B 040406199-0017		Black Fibrous Heterogeneous	Teased	80% Cellulose	20% Non-fibrous (other)	None Detected
0304-103-006C 040406199-0018		Black Fibrous Heterogeneous	Teased	75% Cellulose	25% Non-fibrous (other)	None Detected

Analyst(s)

Wayne Froehlich (21)

Stephen Siegel, CIH
or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. The test results contained within this report meet the requirements of NELAC unless otherwise noted.

Analysis performed by EMSL Westmont (NVLAP #101048-0), NY ELAP 10872

EMSL Analytical, Inc.

107 Haddon Ave., Westmont, NJ 08108

Phone: (856) 858-4800 Fax: (856) 858-4960 Email: ssiegel@EMSL.com**EMSL**Attn: Gary Case
Baker Environmental
100 Airside Drive
Moon Township, PA 15108Fax: (412) 375-3996
Project: 102396 Tasi 00001

Phone: (412) 269-6381

Customer ID: BAKE51
Customer PO:
Received: 04/08/04 10:55 AM
EMSL Order: 040406199
EMSL Proj:
Analysis Date: 4/14/04**Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy**

Sample	Location	Appearance	Treatment	Non-Asbestos		Asbestos
				% Fibrous	% Non-Fibrous	% Type
0304-103-007A 040406199-0019		Black Fibrous Homogeneous	Teased	95% Glass	5% Non-fibrous (other)	None Detected
0304-103-007B 040406199-0020		Black Fibrous Homogeneous	Teased	95% Glass	5% Non-fibrous (other)	None Detected
0304-103-007C 040406199-0021		Black Fibrous Homogeneous	Teased	95% Glass	5% Non-fibrous (other)	None Detected

Analyst(s)

Wayne Froehlich (21)

Stephen Siegel, CIH
or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. The test results contained within this report meet the requirements of NELAC unless otherwise noted.

Analysis performed by EMSL Westmont (NVLAP #101048-0), NY ELAP 10872

Baker

Laboratory Report for Lead in Paint

EMSL Analytical

3 Cooper St., Westmont, NJ 08108

Phone: (856) 858-4800 Fax: (856) 858-9551 Email: skauffman@emsl.com

EMSL

Attn: Gary Case
Baker Environmental
100 Airside Drive
Moon Township, PA 15108

Fax: (412) 375-3996 Phone: (412) 269-6381

Project: Thule AB/ 102396 Task 00001

Customer ID: BAKE51

Customer PO:

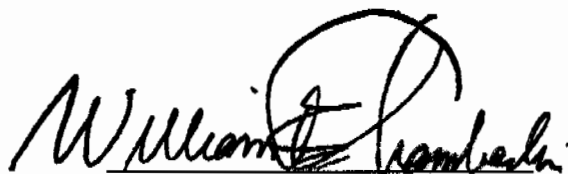
Received: 04/08/04 11:07 AM

EMSL Order: 200403700

EMSL Proj:

Lead in Paint Chips by Flame AAS (SW 846, 7420)

Client Sample Description	Lab ID	Analyzed	Lead Concentration
0304-103-P001	0001	4/15/04	4.20 % wt
0304-103-P002	0002	4/15/04	0.94 % wt
0304-103-P003	0003	4/15/04	2.90 % wt
0304-103-P004	0004	4/15/04	3.50 % wt



William Chamberlin
Laboratory Director
or other approved signatory

Reporting limit is 0.01 % wt. The QC data associated with the sample results included in this report meet the recovery and precision requirements established by the AIHA, unless specifically indicated otherwise in the comment section. The test results contained within this report meet the requirements of NELAP unless otherwise noted. This report relates only to those items tested.

ACCREDITATIONS: NJ-NELAP: 04653, AIHA Environmental Lead Laboratory Approval Program: 100194

5/04 4:59:27 PM

Laboratory Report for TCLP Analysis

EMSL Analytical

3 Cooper St., Westmont, NJ 08108

Phone: (856) 858-4800 Fax: (856) 858-9551 Email: skauffman@emsl.com



Attn: Gary Case
Baker Environmental
100 Airside Drive
Moon Township, PA 15108

Fax: (412) 375-3996

Phone: (412) 269-6381

Project: Thule AB/ 102396, Task 00001

Customer ID: BAKE51

Customer PO:

Received: 04/08/04 11:07 AM

EMSL Order: 200403699

EMSL Proj:

Toxicity Characteristic Leaching Procedure (SW846, 1311/7420)

Client Sample Description	Lab ID	Analyzed	Lead Concentration
0304-103-TCLP	0001	4/12/04	<0.4 mg/L

William Chamberlin
Laboratory Director
or other approved signatory

The test results contained within this report meet the requirements of NELAP unless otherwise noted.

ACCREDITATIONS: NJ-NELAP: 04653, AIHA Environmental Lead Laboratory Approval Program: 100194

Date Printed: 4/12/04 4:17:38 PM

PHOTOGRAPHIC RECORD

SITE NAME: Building 103, Thule AB

PHOTOGRAPH

1

DATE

3/19/04

PHOTOGRAPHS
BY

Baker



Comments: Thermal Pipe and Fitting Insulation in Storage Bay 6.

PHOTOGRAPH

2

DATE

3/19/04

PHOTOGRAPHS
BY

Baker



Comments: Thermal Pipe and Fitting Insulation in Storage Bay 5.

PHOTOGRAPHIC RECORD

SITE NAME: Building 103, Thule AB

PHOTOGRAPH

3

DATE

3/19/04

PHOTOGRAPHS
BY
Baker

Comments: Thermal Pipe and Fitting Insulation in Storage Bay 1.

PHOTOGRAPH

4

DATE
3/19/04

PHOTOGRAPHS
BY
Baker

Comments: Thermal Pipe and Fitting Insulation in Mechanical Room.



PHOTOGRAPHIC RECORD

SITE NAME: Building 103, Thule AB

PHOTOGRAPH

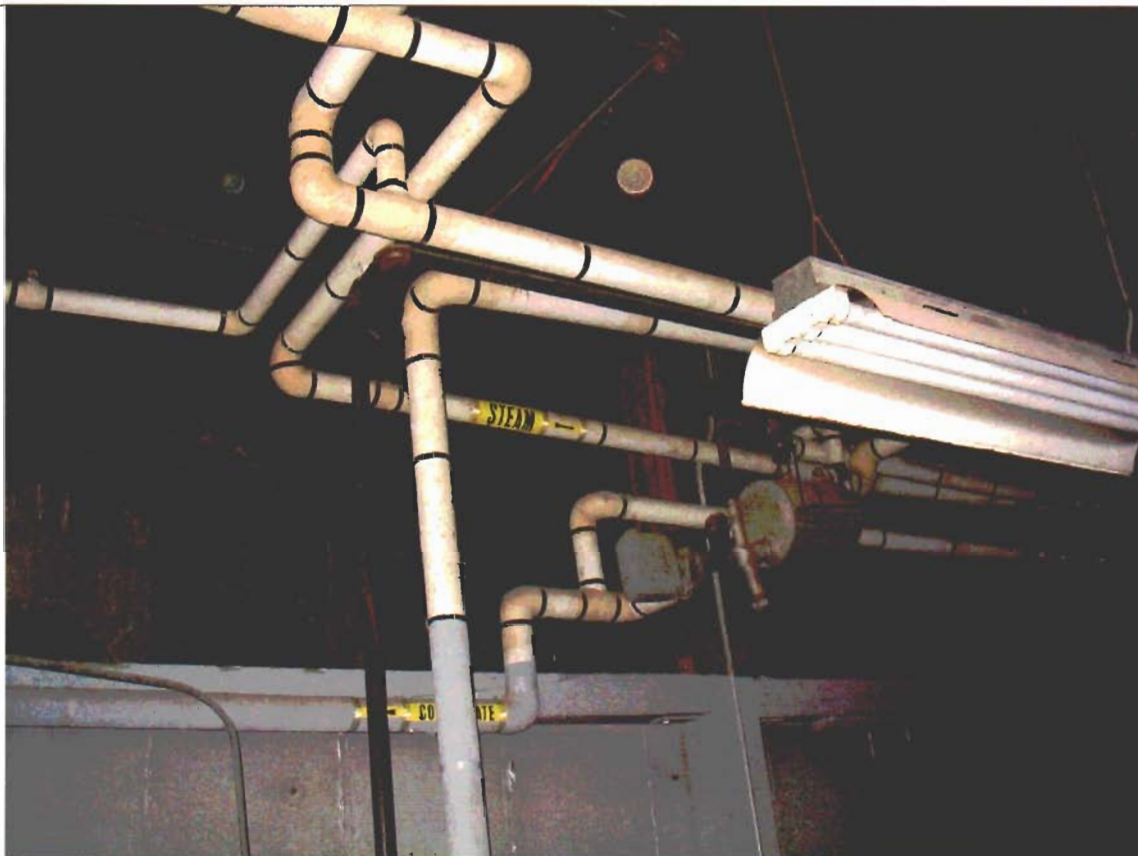
5

DATE

3/19/04

PHOTOGRAPHS
BY

Baker



Comments: Thermal Pipe and Fitting Insulation in Mechanical Room.

PHOTOGRAPH

6

DATE

3/19/04

PHOTOGRAPHS
BY

Baker



Comments: The Flexible Connector in Mechanical Room.

PHOTOGRAPHIC RECORD

SITE NAME: Building 103, Thule AB

PHOTOGRAPH

7

DATE

3/19/04

PHOTOGRAPHS
BY

Baker



Comments: The Blue Paint in Mechanical Room.

PHOTOGRAPH

8

DATE

3/19/04

PHOTOGRAPHS
BY

Baker



Comments: The Gray Paint in Storage Bay 1.

PHOTOGRAPHIC RECORD

SITE NAME: Building 103, Thule AB

PHOTOGRAPH

9

DATE

3/19/04

PHOTOGRAPHS
BY

Baker



Comments: The Yellow/Red Paint in Storage Bay 1.

PHOTOGRAPH

10

DATE

3/19/04

PHOTOGRAPHS
BY

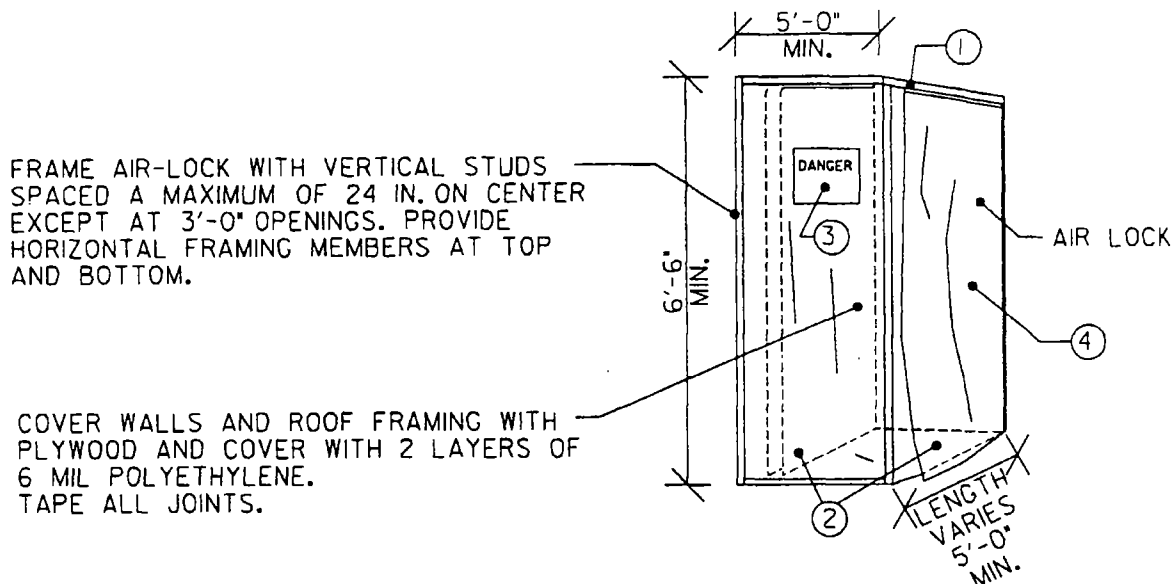
Baker



Comments: The Green Paint on the Exterior.

CEMP-RT Engineer Pamphlet 1110-1-11	Department of the Army U.S. Army Corps of Engineers Washington, DC 20314-1000	EP 1110-1-11 15 July 1992/ 30 September 1997
	Engineering and Design ASBESTOS ABATEMENT GUIDELINE DETAIL SHEETS	
	Distribution Restriction Statement Approved for public release; distribution is unlimited.	

Part 2, Setup Details

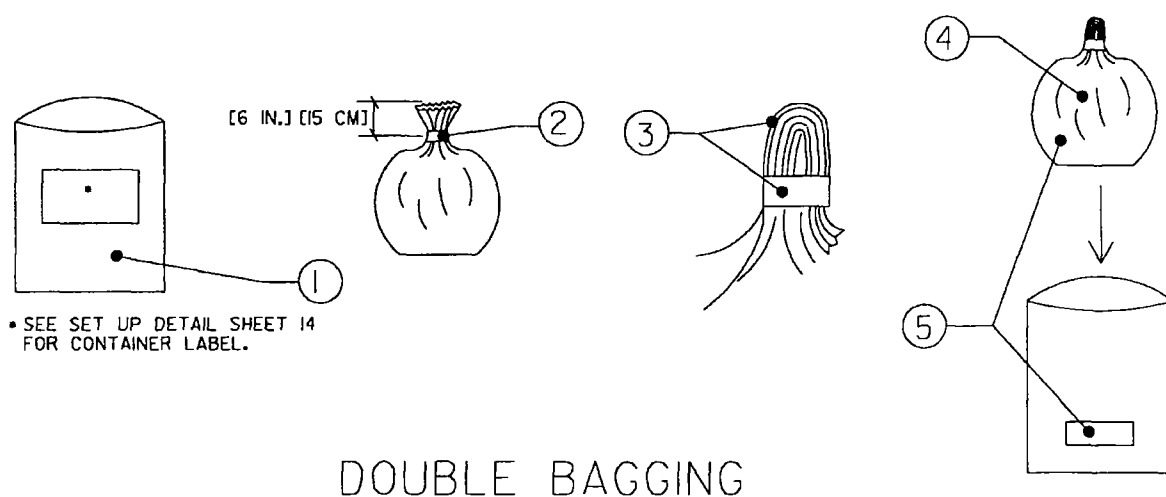


Air lock

1. Establish work area so that unauthorized entry is prevented; see sheet 11. Construct a wood frame. Install one layer of 6-mil polyethylene sheeting to structural members and two layers to the floor. Seal all edges of sheeting to wall, ceiling, and floor surfaces with duct tape.
2. Install triple flaps of 6-mil polyethylene sheeting at both doorways.
3. Install danger signs on each side of air lock area; see sheet 11.
4. Before leaving work area, remove outer suit. Place in a plastic bag; see sheet 9.

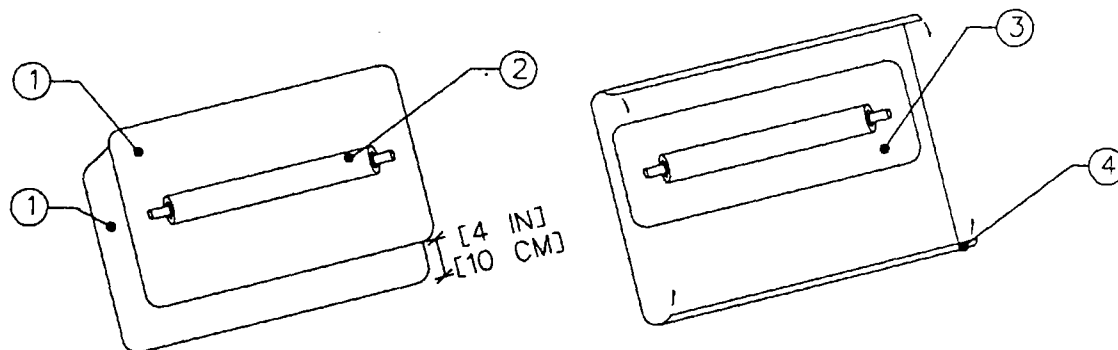
5. Enter air lock. Wet wipe respirator and wash hands with clean water from portable sprayer. Remove respirator, and place in a clean plastic bag. Proceed to shower, where inner suit may be removed.

Final clearance requirements. After abatement is completed, prepare area for final clearance. Contractor and Contracting Officer will certify visual inspection of work area on sheet 19, *Certification of Final Cleaning and Visual Inspection*. Contract designee(s) will conduct final air-clearance monitoring as required by the contract. Remove containment area upon instructions from the Contracting Officer, and treat as asbestos-contaminated material; see sheets 9 and 14.



Containers—double bagging

1. Place the still-wet asbestos-containing and asbestos-contaminated material into a prelabaled 6-mil polyethylene bag. Do not overfill. Do not use bag for asbestos-containing or asbestos-contaminated material that could puncture the bag. (See sheet 9C for packaging items that could puncture bags.)
2. Evacuate with HEPA vacuum, and seal collapsed bag by twisting top [6 in] [15 cm] closed and wrapping with a minimum of two layers of duct tape.
3. Twist top and fold over. Apply second wrap of duct tape.
4. Adequately wet clean outside of disposal bag by wet wiping, and take bag to the equipment and staging area.
5. Place bag inside a second prelabaled 6-mil polyethylene bag.
6. Seal outer bag by repeating steps 2 and 3 above. Take bag to load-out unit; see sheet 20.



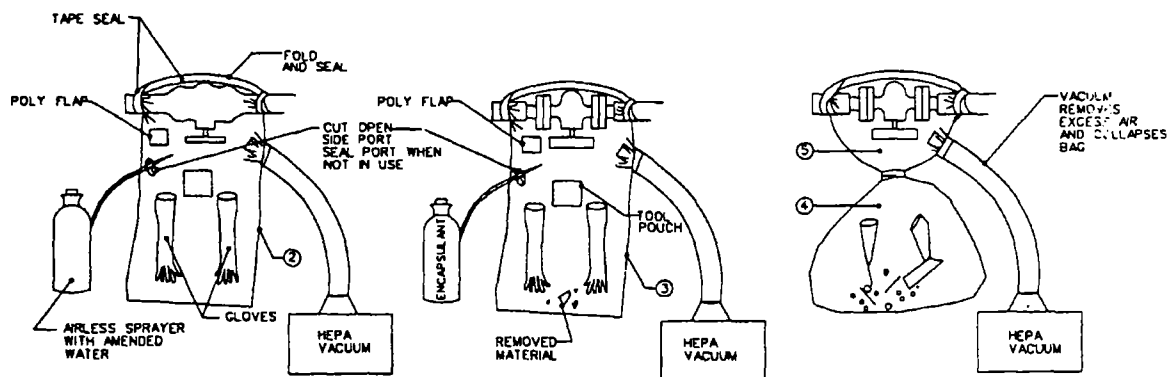
Containers—leak-tight wrapping

1. Place two layers of 6-mil polyethylene sheet on surface so that the bottom layer is offset [4 in] [10 cm] from the top layer.

2. Place the still-wet asbestos-containing or asbestos-contaminated material that is too large (boiler, vessel, pipe segment, etc.) to be placed in disposal bags on the top layer of polyethylene.

3. Wrap the top layer tightly around the contaminated material. Seal all edges of the top layer of sheeting with duct tape. Apply labels; see sheet 14.

4. Repeat procedure with bottom layer, including labeling. Take to load-out unit; see sheet 20.



Glove bag

1. Construct modified containment area in accordance with sheet 21. NOTE: Inspect for structural integrity the insulation material adjacent to section being removed, since glove bag removal procedure is not appropriate if it will cause asbestos fiber release from adjacent asbestos-containing material.

2. Put tools and rags inside glove bag. Insulation adjacent to the asbestos-containing material being removed must be adequately wet cleaned and sprayed with an encapsulant before placing glove bag over the area to be removed. Install glove bag according to manufacturer's instructions. (NOTE: Negative-air glove bags may be used if first approved by Contracting Officer. Manufacturer procedures for negative-air glove bags will vary from procedures identified on this sheet.) Install HEPA filter vacuum cleaner with hose ducted into bag. Seal with duct tape. Smoke test for leaks. Soak insulation with amended water.

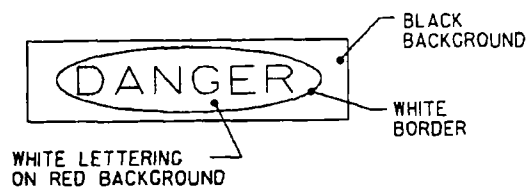
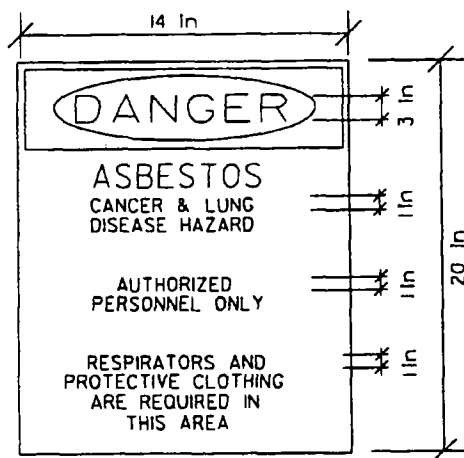
3. Remove insulation and clean exposed metal surfaces. Encapsulate exposed ends of insulation and metal surfaces. Adequately wet clean glove bag surfaces to below tool pouch.

4. Grasp tools in pouch and withdraw by pulling glove inside out. Twist glove above encased tools to create a constriction, and tape constricted area with duct tape. Cut through middle of taped area so that tools and glove bag will both remain sealed. Place encased tools into tool pouch of next glove bag or decontaminate by water immersion.

5. Evacuate glove bag, using HEPA vacuum. Twist bag to create a constriction below tool pouch. Wrap constricted area with duct tape. Cut bag [4 in] [10 cm] above constriction. Double bag cut off portion of bag; see sheet 9. Apply labels; see sheet 14. Cap and seal end of HEPA vacuum hose in order to prevent incidental fiber release.

6. Remove remaining portion of glove bag. Place in approved container; see sheet 9. Apply labels; see sheet 14. Dispose as asbestos-contaminated waste.

Final clearance requirements. For final clearance, Contractor and Contracting Officer will certify visual inspection of work area on sheet 19. **Certification of Final Cleaning and Visual Inspection:** Contract designee(s) will conduct final air-clearance monitoring as required by the contract.












AREA WARNING SIGNS AND WARNING TAPE

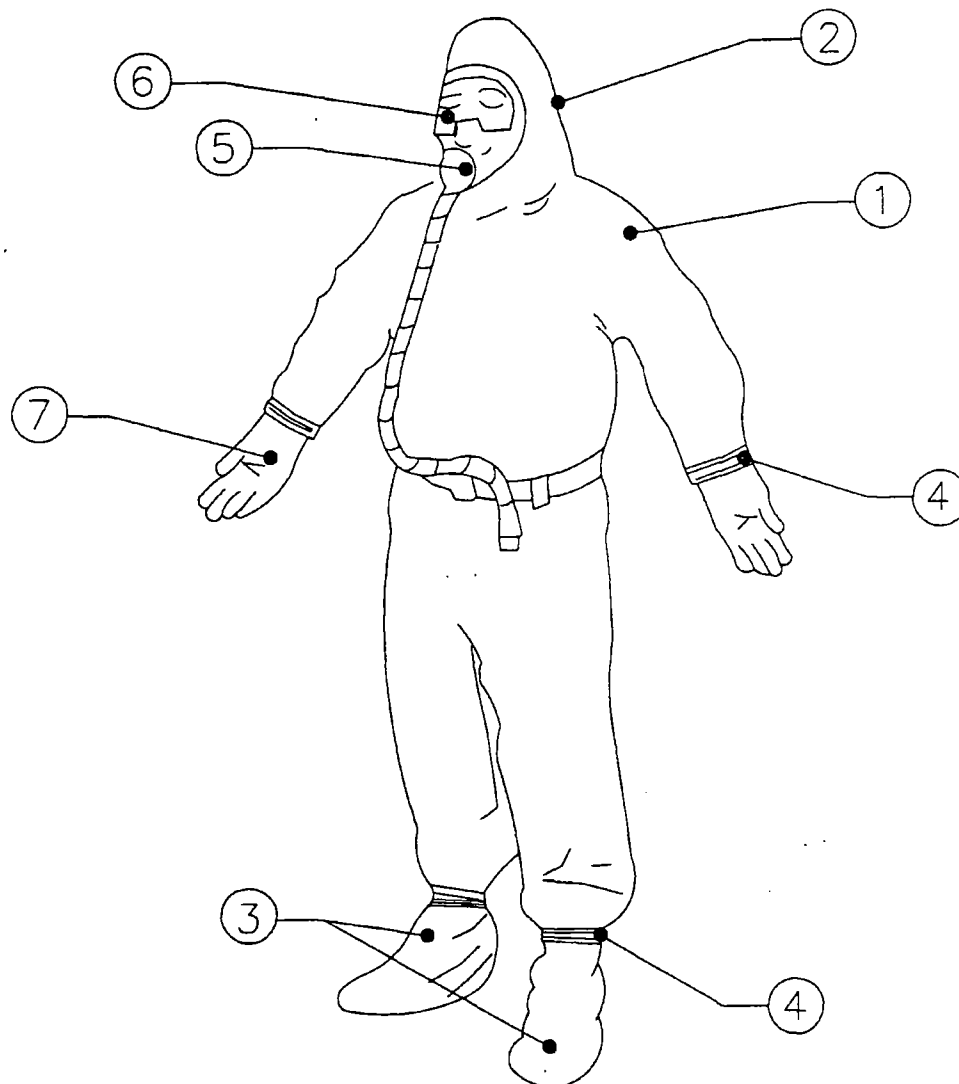
DETAIL 

Area warning signs and warning tape

1. Provide and install [4 mil] [0.10 mm] polyethylene warning tape at locations shown on the abatement area plan.
2. Warning tape is to be attached to wood or metal posts at [10 ft] [300 cm] on center. Tape must be [3 ft] [100 cm] from ground.
3. Attach both warning signs at each entrance of the work area and at [33 yd] [30 m] on center where security fencing is installed.
4. Warning signs must be in English and other languages required by the contract.
5. Install at eye level.

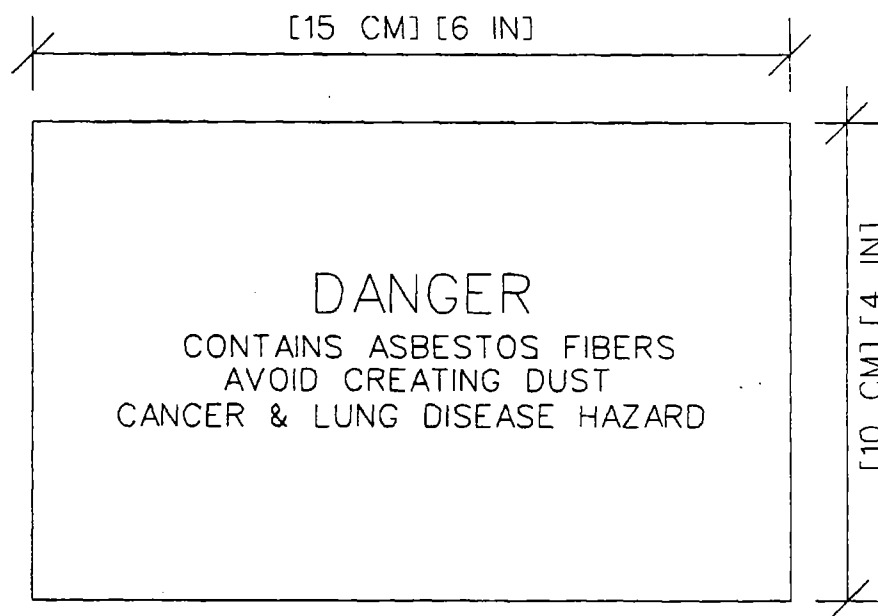
FIBER CONCENTRATION	MINIMUM REQUIRED RESPIRATOR	
NOT IN EXCESS OF 1 FIBER/CC	HALF-MASK AIR PURIFYING RESPIRATOR WITH HEPA FILTERS	
NOT IN EXCESS OF 5 FIBERS/CC	FULL FACEPIECE AIR-PURIFYING RESPIRATOR WITH HEPA FILTERS	HEPA FILTER 
NOT IN EXCESS OF 10 FIBERS/CC	LOOSE FITTING HELMET OR HOOD, POWERED AIR-PURIFYING RESPIRATOR WITH HEPA FILTERS	BATTERY-POWERED BLOWER WITH HEPA FILTER 
NOT IN EXCESS OF 10 FIBERS/CC	POWERED AIR-PURIFYING RESPIRATOR WITH FULL FACEPIECE AND HEPA FILTER	
NOT IN EXCESS OF 10 FIBERS/CC	LOOSE FITTING HELMET OR HOOD, SUPPLIED AIR RESPIRATOR OPERATED IN CONTINUOUS FLOW MODE WITH BACK-UP HEPA FILTER	
NOT IN EXCESS OF 10 FIBERS/CC	SUPPLIED AIR RESPIRATOR WITH FULL FACEPIECE OPERATED IN CONTINUOUS FLOW MODE WITH BACK-UP HEPA FILTER	AIR SUPPLY 
NOT IN EXCESS OF 100 FIBERS/CC	FULL FACEPIECE SUPPLIED AIR RESPIRATOR OPERATED IN PRESSURE-DEMAND MODE WITH BACK-UP HEPA FILTER	AIR SUPPLY 
GREATER THAN 100 FIBERS/CC OR UNKNOWN CONCENTRATION	FULL FACEPIECE SUPPLIED-AIR RESPIRATOR OPERATED IN PRESSURE-DEMAND MODE WITH AUXILIARY POSITIVE-PRESSURE SELF-CONTAINED BREATHING APPARATUS	AUXILIARY POSITIVE-PRESSURE SELF-CONTAINED BREATHING APPARATUS 
		AIR SUPPLY 

Respiratory protection table



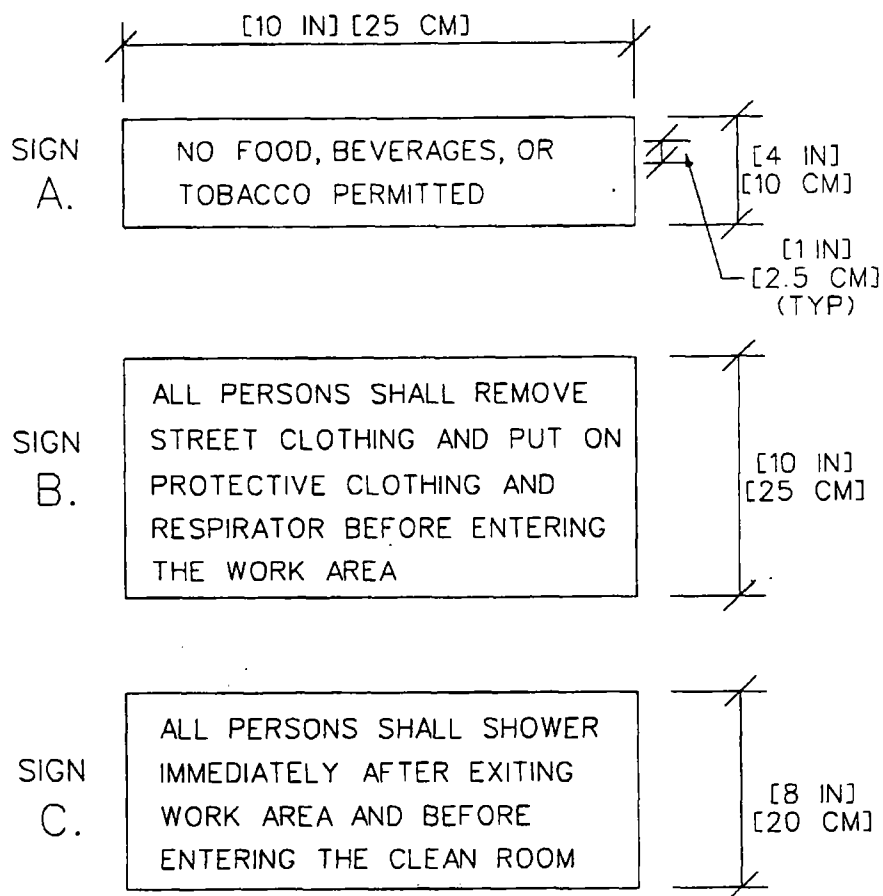
Protective clothing

1. Disposable or reusable full body suit with elastic around hood and shoe cover openings is required or as otherwise specified in the contract.
2. Hood shall be worn over respirator's head and neck straps.
3. Shoe covers shall be worn over work shoes.
4. Cuffs shall be taped with duct tape at wrists and ankles in order to prevent infiltration.
5. Cartridge-type air-purifying HEPA filter respirator is minimal requirement. Type shall be selected in accordance with sheet 12.
6. If eye protection is not integral with respirator, protection goggles are required.
7. Rubber work gloves are recommended to be worn alone or under outer work gloves provided for hand and operation safety.



Disposal container label

Attach warning labels to each disposal container removed from abatement area.



Decontamination unit signage

1. Provide signs in English and other languages required by the contract.
2. Install at eye level.

Certification of Final Cleaning And Visual Inspection

Individual abatement task as identified in paragraph, Description of Work _____

In accordance with the cleaning and decontamination procedures specified in the Contractor's asbestos hazard abatement plan and this contract, the Contractor hereby certifies that he/she has thoroughly visually inspected the decontaminated regulated work area (all surfaces, including pipes, beams, ledges, walls, ceiling, floor, decontamination unit, etc.) in accordance with ASTM E1368, *Standard Practice for Visual Inspection of Asbestos Abatement Projects*, and has found no dust, debris, or asbestos-containing material residue.

BY: (Contractor's signature) _____ Date _____

Print name and title _____

(Contractor's Onsite Supervisor signature) _____ Date _____

Print name and title _____

(Contractor's Industrial Hygienist signature) _____ Date _____

Print name and title _____

Contracting Officer Acceptance or Rejection

The Contracting Officer hereby determines that the Contractor has performed final cleaning and visual inspection of the decontaminated regulated work area (all surfaces including pipes, beams, ledges, walls, ceiling, floor, decontamination unit, etc.) and by quality assurance inspection, finds the Contractor's final cleaning to be:

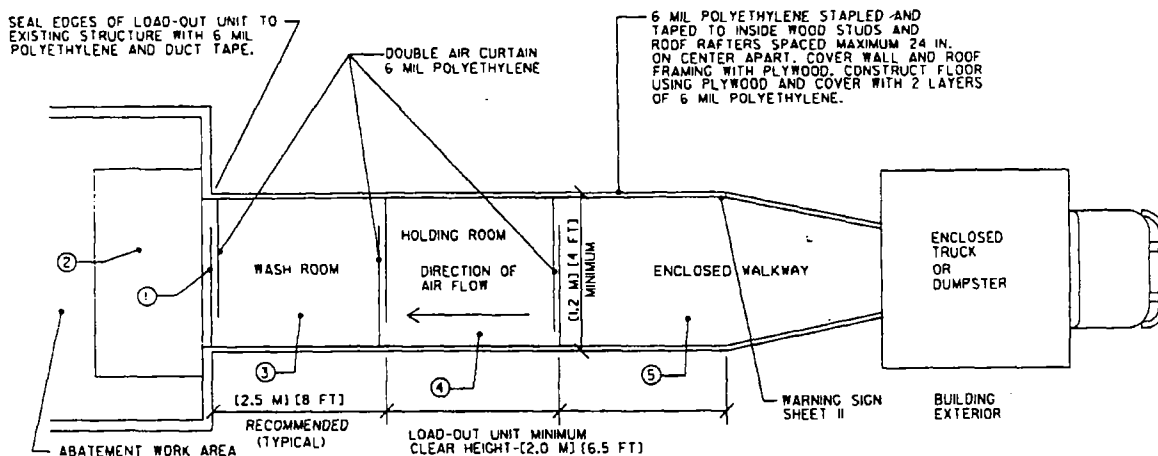
☐ Acceptable

☐ Unacceptable, Contractor instructed to reclean the regulated work area.

BY: Contracting Officer's Representative

Signature _____ Date _____

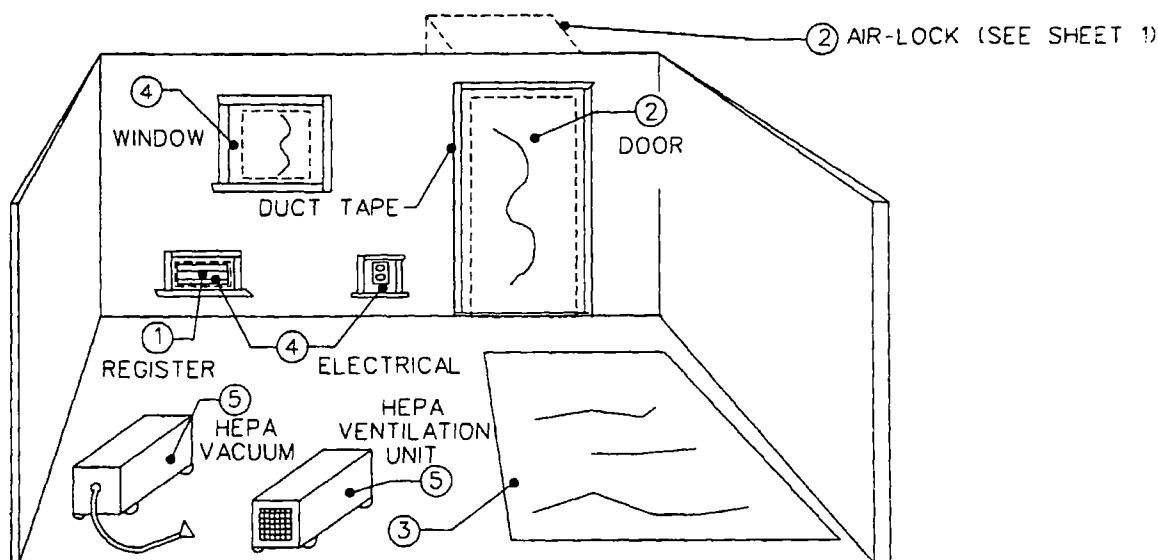
Print name and title _____



Load-out unit floor plan

1. Abatement worker is to enter and exit abatement work area only through decontamination unit.
2. Place additional 6-mil polyethylene sheeting on top of abatement area floor. Double bag asbestos-contaminated material in this area before removing.
3. Wet wipe bags, equipment, and containers, and take to holding room.
4. Stage clean bags, equipment, and containers in holding room until disposal worker removes them.
5. Disposal workers, wearing full protective clothing and appropriate respirator protection, carry decontaminated bags and containers through enclosed walkway and into enclosed truck or Dumpster.

Final clearance requirements. Before breaking down load-out unit, adequately wet clean and HEPA vacuum all surfaces and prepare area for final clearance. Contractor and Contracting Officer will certify visual inspection of work area on sheet 19, *Certification of Final Cleaning and Visual Inspection*. Contractor will apply lockdown encapsulant. Contract designee(s) will conduct final air-clearance monitoring as required by the contract. Breakdown load-out area upon instructions from Contracting Officer. Treat as asbestos-contaminated material. Place in approved container; see sheet 9. Apply labels; see sheet 14. Dispose of as required by the contract.

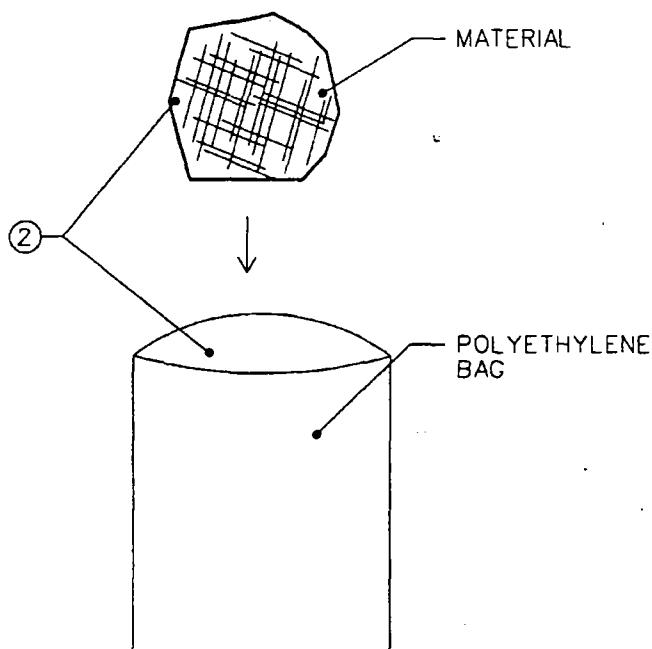


Modified containment area

1. Establish work area and prevent unauthorized entry; see sheet 11. Eliminate airflow into containment area by isolating all supply and return air ducts from mechanical system.
2. Install air lock at entrance to abatement area; see sheet 1. Air lock may be constructed either outside or inside of room. NOTE: Air lock is not required for glove bag operations.
3. Install 6-mil polyethylene sheet on floor under work area.
4. Install 6-mil polyethylene (critical barrier) over all windows, doors, wall openings, electrical outlets, etc. Provide airtight seal, using duct tape.
5. Provide a HEPA-filter vacuum cleaner and a HEPA-filter ventilation system in the work area; see sheet 8. The ventilation system does not have to be ducted to the outside of the structure. The ventilation system shall operate 24 hours a day from start of abatement through final air-clearance monitoring. The ventilation system shall be sized to recirculate the air a minimum of four air changes per hour. For glove bag operations, provide a single HEPA ventilation unit with a measured capture velocity at least 1,500 cfm.

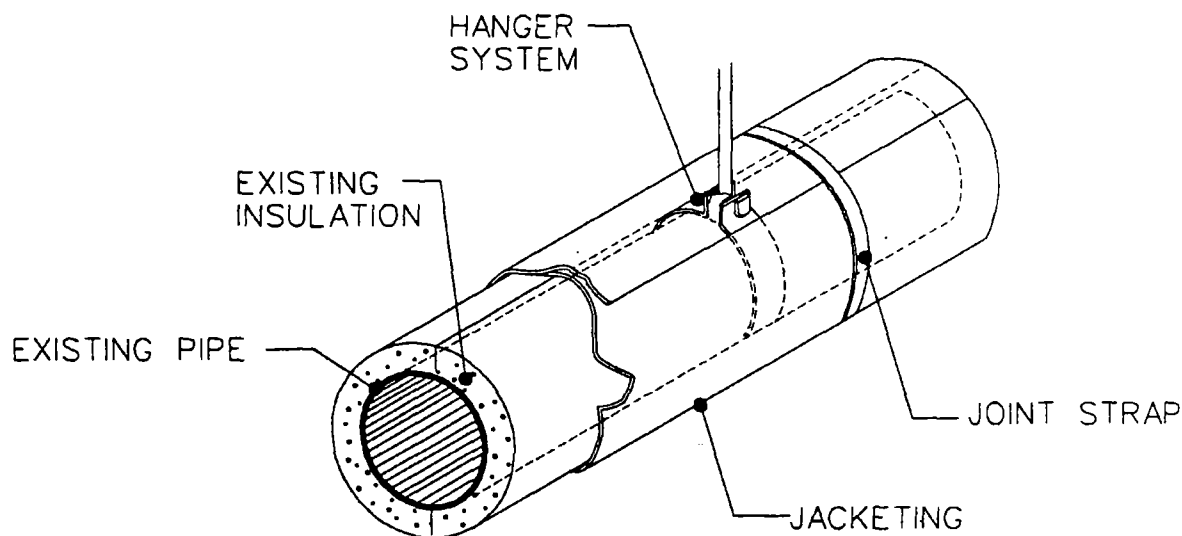
6. Accumulate all loose material and polyethylene from floor. Place in approved container; see sheet 9. Apply labels; see sheet 14. HEPA vacuum and adequately wet clean all wall, floor, and equipment surfaces.

Final clearance requirements. Abatement worker must wear two disposable suits. Remove outer suit in the work area. Place suit in 6-mil disposal bag; see sheet 9. Enter air lock. In air lock, wet wipe respirator and wash hands with clean water from portable sprayer. Remove respirator and place in clean plastic bag. Proceed to remote shower where inner suit may be removed. Prepare work area and air lock for final clearance. Contractor and Contracting Officer will certify visual inspection of work area on sheet 19, *Certification of Final Cleaning and Visual Inspection*. Contract designee(s) will conduct final air-clearance monitoring as required by the contract. Upon instructions from the Contracting Officer, remove critical barriers and HEPA ventilation units; see sheet 8. Treat polyethylene as asbestos-contaminated material. Place in approved container; see sheet 9. Apply labels; see sheet 14. Dispose of as required by the contract.



Removal of miscellaneous asbestos-containing materials

1. Establish work area so that unauthorized entry is prevented; see sheet 11. Prepare containment area as specified on sheet 21.
2. Adequately wet mist materials with amended water. Remove and place in approved container; see sheet 9. Apply labels; see sheet 14.
3. HEPA vacuum and wet wipe area in the immediate vicinity of removed materials.
4. Prepare area for final clearance.
5. Carry out final clearance requirements as specified on sheet 21.



NOTE: THIS SHEET CAN BE USED FOR
VERTICAL OR HORIZONTAL PIPING.

Removal of pipe insulation (using glove bag)

1. Install glove bag as specified on sheet 10. Prepare modified containment area as specified on sheet 21. Adequately wet mist insulation surface with amended water, initially and during removal.
2. Remove jacketing and asbestos pipe insulation from pipe and hanger to within 2 inches of inside edges of glove bag.
3. Clean exposed surfaces by spraying with amended water and brushing.
4. Inspect and reclean as necessary.
5. Spray a tinted penetrating encapsulant on pipe and exposed ends of insulation.
6. Inspect piping and reapply encapsulant as necessary.
7. Prepare area for final air clearance.
8. Carry out final clearance requirements specified on sheets 10 and 21.

SECTION 13282N

LEAD IN CONSTRUCTION
08/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z88.2 (1992) Respiratory Protection

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926.103	Respiratory Protection
29 CFR 1926.21	Safety Training and Education
29 CFR 1926.33	Access to Employee Exposure and Medical Records
29 CFR 1926.55	Gases, Vapors, Fumes, Dusts, and Mists
29 CFR 1926.59	Hazard Communication
29 CFR 1926.62	Lead
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment,

Storage, and Disposal Facilities

40 CFR 268

Land Disposal Restrictions

49 CFR 172

Hazardous Materials Table, Special
Provisions, Hazardous Materials
Communications, Emergency Response
Information, and Training Requirements

49 CFR 178

Specifications for Packagings

UNDERWRITERS LABORATORIES (UL)

UL 586

(1996; Rev thru Apr 2000) High-Efficiency,
Particulate, Air Filter Units

THULE AB REGULATIONS

- 1) Standards Governing Environmental Protection for U.S.
Installations in Greenland
- 2) Final Governing Standards (FGS), Chapter 15, Paragraph 15.4
- 3) Thule AB Lead Paint Operating and Management Plans

1.2 DEFINITIONS

1.2.1 Action Level

Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8 hour period.

1.2.2 Area Sampling

Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations but is not collected in the breathing zone of personnel (approximately 1.5 to 1.8 meters above the floor).

1.2.3 Competent Person (CP)

As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the lead hazard. A Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene or a Certified Safety Professional (CSP) certified by the Board of Certified Safety Professionals is the best choice.

1.2.4 Contaminated Room

Refers to a room for removal of contaminated personal protective equipment

(PPE).

1.2.5 Decontamination Shower Facility

That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.

1.2.6 High Efficiency Particulate Arrestor (HEPA) Filter Equipment

HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated particulate. A high efficiency particulate filter demonstrates at least 99.97 percent efficiency against 0.3 micron or larger size particles.

1.2.7 Lead

Metallic lead, inorganic lead compounds, and organic lead soaps. Excludes other forms of organic lead compounds.

1.2.8 Lead Control Area

A system of control methods to prevent the spread of lead dust, paint chips or debris to adjacent areas that may include temporary containment, floor or ground cover protection, physical boundaries, and warning signs to prevent unauthorized entry of personnel. HEPA filtered local exhaust equipment may be used as engineering controls to further reduce personnel exposures or building/outdoor environmental contamination.

1.2.9 Lead Permissible Exposure Limit (PEL)

Fifty micrograms per cubic meter of air as an 8 hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than eight hours in a work day, the PEL shall be determined by the following formula:

$$\text{PEL (micrograms/cubic meter of air)} = 400/\text{No. hrs worked per day}$$

1.2.10 Material Containing Lead/Paint with Lead (MCL/PWL)

Any material, including paint, which contains lead as determined by the testing laboratory using a valid test method. The requirements of this section does not apply if no detectable levels of lead are found using a quantitative method for analyzing paint or MCL using laboratory instruments with specified limits of detection (usually 0.01%). An X-Ray Fluorescence (XRF) instrument is not considered a valid test method.

1.2.11 Personal Sampling

Sampling of airborne lead concentrations within the breathing zone of an employee to determine the 8 hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples shall be representative of the employees' work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 150 to 225 mm 6 to 9

inches and centered at the nose or mouth of an employee.

1.2.12 Physical Boundary

Area physically roped or partitioned off around lead control area to limit unauthorized entry of personnel.

1.3 DESCRIPTION

1.3.1 Description of Work

Construction activities impacting PWL or material containing lead which are covered by this specification include the demolition and/or removal of material containing lead in good to poor condition, located at Building 103.

1.3.2 Coordination with Other Work

The contractor shall coordinate with work being performed in adjacent areas. Coordination procedures shall be explained in the Plan and shall describe how the Contractor will prevent lead exposure to other contractors and/or Government personnel performing work unrelated to lead activities.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Lead Compliance Plan including CP approval
(signature, date, and certification number); G

Competent Person qualifications; G

Training Certification of workers and supervisors; G

lead waste management plan; G
written evidence that TSD is approved for lead disposal; G

Certification of Medical Examinations; G

SD-06 Test Reports

sampling results; G

Occupational and Environmental Assessment Data Report; G

SD-07 Certificates

Testing laboratory qualifications; G

Clearance Certification; G

SD-11 Closeout Submittals

Completed and signed hazardous waste manifest from treatment or disposal facility; G

Waste turn-in documents or weight tickets for non-hazardous wastes that are disposed of at sanitary or construction and demolition landfills; G

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

1.5.1.1 Competent Person (CP)

Submit name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph entitled "Competent Person (CP) Responsibilities." Provide documented construction project-related experience with implementation of OSHA's Lead in Construction standard (29 CFR 1926.62) which shows ability to assess occupational and environmental exposure to lead, experience with the use of respirators, personal protective equipment and other exposure reduction methods to protect employee health. Submit proper documentation that the CP is trained and certified in accordance with federal, State and local laws. .

1.5.1.2 Training Certification

Submit a certificate for each worker and supervisor, signed and dated by the accredited training provider, stating that the employee has received the required lead training specified in 29 CFR 1926.62(1).

1.5.1.3 Testing Laboratory

Submit the name, address, and telephone number of the testing laboratory selected to perform the air analysis, testing, and reporting of airborne concentrations of lead. Use a laboratory participating in the EPA National Lead Laboratory Accreditation Program (NLLAP) by being accredited by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis. Laboratories selected to perform blood lead analysis shall be OSHA approved.

1.5.2 Requirements

1.5.2.1 Competent Person (CP) Responsibilities

- a. Verify training meets all federal, State, and local requirements.
- b. Review and approve Lead Compliance Plan for conformance to the applicable referenced standards.

- c. Continuously inspect PWL or MCL work for conformance with the approved plan.
- d. Perform (or oversee performance of) air sampling. Recommend upgrades or downgrades (whichever is appropriate based on exposure) on the use of PPE (respirators included) and engineering controls.
- e. Ensure work is performed in strict accordance with specifications at all times.
- f. Control work to prevent hazardous exposure to human beings and to the environment at all times.
- g. Supervise final cleaning of the lead control area, take clearance wipe samples if necessary; review clearance sample results and make recommendations for further cleaning.
- h. Certify the conditions of the work as called for elsewhere in this specification.

1.5.2.2 Lead Compliance Plan

Submit a detailed job-specific plan of the work procedures to be used in the disturbance of PWL or MCL. The plan shall include a sketch showing the location, size, and details of lead control areas, critical barriers, physical boundaries, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include a description of equipment and materials, work practices, controls and job responsibilities for each activity from which lead is emitted. Include in the plan, eating, drinking, smoking, hygiene facilities and sanitary procedures, interface of trades, sequencing of lead related work, collected waste water and dust containing lead and debris, air sampling, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that lead is not released outside of the lead control area. Include site preparation, cleanup and clearance procedures. Include occupational and environmental sampling, training and strategy, sampling and analysis strategy and methodology, frequency of sampling, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan. Include a description of arrangements made among contractors on multicontractor worksites to inform affected employees and to clarify responsibilities to control exposures.

1.5.2.3 Occupational and Environmental Assessment Data Report

If initial monitoring is necessary, submit occupational and environmental sampling results to the Contracting Officer within three working days of collection, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the CP.

In order to reduce the full implementation of 29 CFR 1926.62, the Contractor shall provide documentation. Submit a report that supports the determination to reduce full implementation of the requirements of 29 CFR 1926.62 and supporting the Lead Compliance Plan.

a. The initial monitoring shall represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures per 29 CFR 1926.62. The data shall represent the worker's regular daily exposure to lead for stated work.

b. Submit worker exposure data gathered during the task based trigger operations of 29 CFR 1926.62 with a complete process description. This includes manual demolition, manual scraping, manual sanding, heat gun, power tool cleaning, rivet busting, cleanup of dry expendable abrasives, abrasive blast enclosure removal, abrasive blasting, welding, cutting and torch burning where lead containing coatings are present.

c. The initial assessment shall determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the lead compliance plan per 29 CFR 1926.62.

1.5.2.4 Medical Examinations

Initial medical surveillance as required by 29 CFR 1926.62 shall be made available to all employees exposed to lead at any time (1 day) above the action level. Full medical surveillance shall be made available to all employees on an annual basis who are or may be exposed to lead in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62. Adequate records shall show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62 and 29 CFR 1926.103. Provide medical surveillance to all personnel exposed to lead as indicated in 29 CFR 1926.62. Maintain complete and accurate medical records of employees for the duration of employment plus 30 years.

1.5.2.5 Training

Train each employee performing work that disturbs lead, who performs MCL/PWL disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, and State and local regulations where appropriate.

1.5.2.6 Respiratory Protection Program

a. Provide each employee required to wear a respirator a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62.

b. Establish and implement a respiratory protection program as required by ANSI Z88.2, 29 CFR 1926.103, 29 CFR 1926.62, and 29 CFR 1926.55.

1.5.2.7 Hazard Communication Program

Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.

1.5.2.8 Lead Waste Management

The Lead Waste Management Plan shall comply with applicable requirements of local hazardous waste regulations (namely Thule AB). and address:

- a. Identification and classification of wastes associated with the work.
- b. Estimated quantities of wastes to be generated and disposed of.
- c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a 24-hour point of contact. Furnish two copies of local hazardous waste manifests.
- d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
- e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
- f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.
- g. Work plan and schedule for waste containment, removal and disposal. Proper containment of the waste includes using acceptable waste containers (e.g., 55-gallon drums) as well as proper marking/labeling of the containers. Wastes shall be cleaned up and containerized daily.
- h. Include any process that may alter or treat waste rendering a hazardous waste non hazardous.
- i. Unit cost for hazardous waste disposal according to this plan.

1.5.2.9 Environmental, Safety and Health Compliance

In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, State, and local authorities regarding lead. Comply with the applicable requirements of the current issue of 29 CFR 1926.62. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirement shall apply. The following local laws, ordinances, criteria, rules and regulations regarding removing, handling, storing, transporting, and disposing of lead-contaminated materials apply:

- a. Standards Governing Environmental Protection for U.S. Installations in Greenland
- b. Final Governing Standards (FGS), Chapter 15, Paragraph 15.4
- c. Thule AB Lead Paint Operating and Management Plans

1.5.3 Pre-Construction Conference

Along with the CP, meet with the Contracting Officer to discuss in detail the Lead Waste Management Plan and the Lead Compliance Plan, including procedures and precautions for the work.

1.6 EQUIPMENT

1.6.1 Respirators

Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead dust, fume and mist. Respirators shall comply with the requirements of 29 CFR 1926.62.

1.6.2 Special Protective Clothing

Furnish personnel who will be exposed to lead-contaminated dust with proper disposable protective whole body clothing, head covering, gloves, eye, and foot coverings as required by 29 CFR 1926.62. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.

1.6.3 Rental Equipment Notification

If rental equipment is to be used during PWL or MCL handling and disposal, notify the rental agency in writing concerning the intended use of the equipment.

1.6.4 Vacuum Filters

UL 586 labeled HEPA filters.

1.6.5 Equipment for Government Personnel

Furnish the Contracting Officer with two complete sets of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the lead removal work within the lead controlled area. Personal protective equipment shall include disposable whole body covering, including appropriate foot, head, eye, and hand protection. PPE shall remain the property of the Contractor. The Government will provide respiratory protection for the Contracting Officer.

1.7 PROJECT/SITE CONDITIONS

1.7.1 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better as determined by the Contracting Officer.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

3.1.1.1 Notification

- a. Notify the Contracting Officer 20 days prior to the start of any lead work.

3.1.1.2 Lead Control Area

- a. Physical Boundary - Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that lead will not escape outside of the lead control area.
- b. Warning Signs - Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.

3.1.1.3 Furnishings

The Government will remove furniture and equipment from the building before lead work begins.

3.1.1.4 Decontamination Shower Facility

Provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62.

3.1.1.5 Eye Wash Station

Where eyes may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes shall be provided within the work area.

3.1.1.6 Personnel Protection

Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been appropriately trained and provided with protective equipment.

3.2 ERECTION

3.2.1 Lead Control Area Requirements

Establish a lead control area by completely establishing barriers and

physical boundaries around the area or structure where PWL or MCL removal operations will be performed.

3.3 APPLICATION

3.3.1 Lead Work

Perform lead work in accordance with approved Lead Compliance Plan. Use procedures and equipment required to limit occupational exposure and environmental contamination with lead when the work is performed in accordance with 29 CFR 1926.62, and as specified herein. Dispose of all PWL or MCL and associated waste in compliance with federal, State, and local requirements.

3.3.2 Personnel Exiting Procedures

Whenever personnel exit the lead-controlled area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn in the control area:

- a. Vacuum all clothing before entering the contaminated change room.
- b. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.
- c. Wash hands and face at the site.
- d. Change to clean clothes prior to leaving the clean clothes storage area.

3.4 FIELD QUALITY CONTROL

3.4.1 Tests

3.4.1.1 Air Sampling

Conduct sampling for lead in accordance with 29 CFR 1926.62 and as specified herein. Air sampling shall be directed or performed by the CP.

- a. The CP shall be on the job site directing the air sampling and inspecting the PWL or MCL removal work to ensure that the requirements of the contract have been satisfied during the entire PWL or MCL operation.
- b. Collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least twenty-five percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.
- c. Submit results of air samples, signed by the CP, within 72 hours after the air samples are taken.
- d. Conduct area air sampling daily, on each shift in which lead-based

paint removal operations are performed, in areas immediately adjacent to the lead control area. Sufficient area monitoring shall be conducted to ensure unprotected personnel are not exposed at or above 30 micrograms per cubic meter of air. If 30 micrograms per cubic meter of air is reached or exceeded, stop work, correct the conditions(s) causing the increased levels. Notify the Contracting Officer immediately. Determine if condition(s) require any further change in work methods. Removal work shall resume only after the CP and the Contracting Officer give approval.

3.4.1.2 Testing of Material Containing Lead Residue

Test residue in accordance with 40 CFR 261 for hazardous waste.

3.5 CLEANING AND DISPOSAL

3.5.1 Cleanup

Maintain surfaces of the lead control area free of accumulations of dust and debris. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use pressurized air to clean up the area. At the end of each shift and when the lead operation has been completed, clean the controlled area of visible contamination by control methods as indicated by the Lead Compliance Plan. Reclean areas showing debris. If adjacent areas become contaminated at any time during the work, clean, and visually inspect all contaminated areas. The CP shall then certify in writing that the area has been cleaned of lead contamination before releasing area.

3.5.1.1 Clearance Certification

The CP shall certify in writing that air samples collected outside the lead control area during paint removal operations are less than 30 micrograms per cubic meter of air; the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with 29 CFR 1926.62; and that there were no visible accumulations of material and dust containing lead left in the work site. Do not remove the lead control area or roped off boundary and warning signs prior to the Contracting Officer's acknowledgement of receipt of the CP certification.

3.5.2 Disposal

a. All material, whether hazardous or non-hazardous shall be disposed in accordance with all laws and provisions and all federal, State or local (Thule AB) regulations. Ensure all waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.

b. Contractor is responsible for segregation of waste. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing that may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62 and 40 CFR 261.

- c. Dispose of lead-contaminated material classified as hazardous waste at an approved hazardous waste treatment, storage, or disposal facility off Government property.
- d. Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 208 liter drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. For hazardous waste, the collection drum requires marking/labeling in accordance with 40 CFR 262 during the accumulation/collection timeframe. The Contracting Officer or an authorized representative will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.
- e. Handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.

3.5.2.1 Disposal Documentation

Submit written evidence to demonstrate the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA, State or local regulatory agencies. Submit one copy of the completed hazardous waste manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Contractor shall provide a certificate that the waste was accepted by the disposal facility. Provide turn-in documents or weight tickets for non-hazardous waste disposal.

3.5.2.2 Payment for Hazardous Waste

Payment for disposal of hazardous and non-hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials or non-hazardous waste delivered is returned and a copy is furnished to the Government.

-- End of Section --

SECTION 13851A

FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE
02/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S3.41 (1990; R 1996) Audible Emergency
Evacuation Signal

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Surge Voltages in
Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

NFPA 72 (1999) National Fire Alarm Code

NFPA 90A (1999) Installation of Air Conditioning
and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 1242 (1996; Rev Mar 1998) Intermediate Metal
Conduit

UL 1971 (1995; Rev thru Apr 1999) Signaling
Devices for the Hearing Impaired

UL 268 (1996; Rev thru Jan 1999) Smoke Detectors
for Fire Protective Signaling Systems

UL 268A (1998) Smoke Detectors for Duct Application

UL 38 (1999) Manually Actuated Signaling Boxes
for Use with Fire-Protective Signaling
Systems

UL 464 (1996; Rev thru May 1999) Audible Signal
Appliances

UL 521	(1999) Heat Detectors for Fire Protective Signaling Systems
UL 6	(1997) Rigid Metal Conduit
UL 797	(1993; Rev thru Mar 1997) Electrical Metallic Tubing
UL 864	(1996; Rev thru Mar 1999) Control Units for Fire Protective Signaling Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fire Alarm Reporting System; G, AE

Detail drawings, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical detectors. The Contractor shall check the layout based on the actual detectors to be installed and make any necessary revisions in the detail drawings. The detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Detailed point-to-point wiring diagram shall be prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician showing points of connection. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and equipment that is activated or controlled by the panel.

SD-03 Product Data

Storage Batteries; G,

Substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included.

Voltage Drop; G,

Voltage drop calculations for notification appliance circuits to

indicate that sufficient voltage is available for proper appliance operation.

Special Tools and Spare Parts; FIO,

Spare parts data for each different item of material and equipment specified, not later than 3 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 year of service.

Technical Data and Computer Software; G, FIO

Technical data which relates to computer software.

Training; FIO,

Lesson plans, operating instructions, maintenance procedures, and training data, furnished in manual format, for the training courses. The operations training shall familiarize designated government personnel with proper operation of the fire alarm system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

Testing; G,

Detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, for the fire detection and alarm system 60 days prior to performing system tests.

SD-06 Test Reports

Testing; G,

Test reports, in booklet form, showing field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall document readings, test results and indicate the final position of controls. The Contractor shall include the NFPA 72 Certificate of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports.

SD-07 Certificates

Equipment; G,

Certified copies of current approvals or listings issued by an independent test lab if not listed by UL, FM or other nationally recognized testing laboratory, showing compliance with specified NFPA standards.

Qualifications; FIO,

Proof of qualifications for required personnel. The installer shall submit proof of experience for the Professional Engineer, fire alarm technician, and the installing company.

SD-10 Operation and Maintenance Data

Technical Data and Computer Software; G,
Six copies of operating manual outlining step-by-step procedures required for system startup, operation, and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and complete description of equipment and their basic operating features. Six copies of maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed. The manuals shall include complete procedures for system revision and expansion, detailing both equipment and software requirements. Original and backup copies of all software delivered for this project shall be provided, on each type of media utilized. Manuals shall be approved prior to training.

1.3 GENERAL REQUIREMENTS

1.3.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours of notification.

1.3.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

1.3.3 Keys and Locks

Locks shall be keyed alike. Four keys for the system shall be provided.

1.3.4 Tags

Tags with stamped identification number shall be furnished for keys and locks.

1.3.5 Verification of Dimensions

After becoming familiar with details of the work, the Contractor shall verify dimensions in the field and shall advise the Contracting Officer of

any discrepancy before performing the work.

1.3.6 Compliance

The fire detection and alarm system and the central reporting system shall be configured in accordance with NFPA 72; exceptions are acceptable as directed by the Contracting Officer. The equipment furnished shall be compatible and be UL listed, FM approved, or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

1.3.7 Qualifications

1.3.7.1 Engineer and Technician

a. Registered Professional Engineer with verification of experience and at least 4 years of current experience in the design of the fire protection and detection systems.

b. National Institute for Certification in Engineering Technologies (NICET) qualifications as an engineering technician in fire alarm systems program with verification of experience and current NICET certificate.

c. The Registered Professional Engineer may perform all required items under this specification. The NICET Fire Alarm Technician shall perform only the items allowed by the specific category of certification held.

1.3.7.2 Installer

The installing Contractor shall provide the following: Fire Alarm Technicians to perform the installation of the system. A Fire Alarm Technician with a minimum of 4 years of experience shall perform/supervise the installation of the fire alarm system. Fire Alarm Technicians with a minimum of 2 years of experience shall be utilized to assist in the installation and terminate fire alarm devices, cabinets and panels. An electrician shall be allowed to install wire or cable and to install conduit for the fire alarm system. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.3.7.3 Design Services

Installations requiring designs or modifications of fire detection, fire alarm, or fire suppression systems shall require the services and review of a qualified fire protection engineer. For the purposes of meeting this requirement, a qualified fire protection engineer is defined as an individual meeting one of the following conditions:

- a. An engineer having a Bachelor of Science or Masters of Science Degree in Fire Protection Engineering from an accredited university engineering program, plus a minimum of 2 years' work experience in fire protection engineering.

- b. A registered professional engineer (P.E.) in fire protection engineering.
- c. A registered PE in a related engineering discipline and member grade status in the National Society of Fire Protection Engineers.
- d. An engineer with a minimum of 10 years' experience in fire protection engineering and member grade status in the National Society of Fire Protection Engineers.

1.4 SYSTEM DESIGN

1.4.1 Operation

The fire alarm and detection system shall be a complete, supervised fire alarm reporting system. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm initiating devices shall be connected to initiating device circuits (IDC), Style B , to signal line circuits (SLC), Style 5 , in accordance with NFPA 72. Alarm notification appliances shall be connected to notification appliance circuits (NAC), Style Z in accordance with NFPA 72. A looped conduit system shall be provided so that if the conduit and all conductors within are severed at any point, all IDC, NAC and SLC will remain functional. The conduit loop requirement is not applicable to the signal transmission link from the local panels (at the protected premises) to the Supervising Station (fire station, fire alarm central communication center). Textual, audible, and visual appliances and systems shall comply with NFPA 72. Fire alarm system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc. Addressable system shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits and shall provide the following features:

- a. Sufficient memory to perform as specified and as shown for addressable system.
- b. Individual identity of each addressable device for the following conditions: alarm; trouble; open; short; and appliances missing/failed remote detector - sensitivity adjustment from the panel for smoke detectors
- c. Capability of each addressable device being individually disabled or enabled from the panel.
- d. Each SLC shall be sized to provide 40 percent addressable expansion without hardware modifications to the panel.

1.4.2 Operational Features

The system shall have the following operating features:

- a. Monitor electrical supervision of IDC, SLC, and NAC.

- b. Monitor electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.
- c. A trouble buzzer and trouble LED/LCD (light emitting diode/liquid crystal diode) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator LED/LCD. Subsequent trouble and supervisory alarms shall sound the trouble signal until silenced. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.
- d. A one person test mode. Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.
- e. A transmitter disconnect switch to allow testing and maintenance of the system without activating the transmitter but providing a trouble signal when disconnected and a restoration signal when reconnected.
- f. Evacuation alarm silencing switch which, when activated, will silence alarm devices, but will not affect the zone indicating LED/LCD nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed device and the NAC devices will be activated.
- g. Electrical supervision for circuits used for supervisory signal services (i.e., sprinkler systems, valves, etc.). Supervision shall detect any open, short, or ground.
- h. Confirmation or verification of all smoke detectors. The control panel shall interrupt the transmission of an alarm signal to the system control panel for a factory preset period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at 20 seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an alarm signal, if present, will be sent immediately to the control panel. Fire alarm devices other than smoke detectors shall be programmed without confirmation or verification.
- i. The fire alarm control panel shall provide supervised addressable relays for HVAC shutdown. An override at the HVAC panel shall not

be provided.

- j. Provide one person test mode - Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.
- k. The fire alarm control panel shall provide the required monitoring and supervised control outputs needed to accomplish elevator recall.
- l. The fire alarm control panel shall monitor the fire sprinkler system, or other fire protection extinguishing system.
- m. The control panel shall be software reprogrammable to enable expansion or modification of the system without replacement of hardware or firmware. Examples of required changes are: adding or deleting devices or zones; changing system responses to particular input signals; programming certain input signals to activate auxiliary devices.

1.4.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate the following functions:

- a. Transmission of a signal over the station fire reporting system. .
- b. Visual indications of the alarmed devices on the fire alarm control panel display .
- c. Continuous sounding or operation of alarm notification appliances throughout the building as required by ANSI S3.41.
- d. Closure of doors held open by electromagnetic devices.
- e. Operation of the smoke control system.
- f. Deactivation of the air handling units throughout the building.

1.4.4 Primary Power

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

1.4.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

1.4.6 Interface With other Equipment

Interfacing components shall be furnished as required to connect to subsystems or devices which interact with the fire alarm system, such as supervisory or alarm contacts in suppression systems, operating interfaces for smoke control systems, door releases, etc.

1.5 TECHNICAL DATA AND COMPUTER SOFTWARE

Technical data and computer software (meaning technical data which relates to computer software) which is specifically identified in this project, and which may be defined/required in other specifications, shall be delivered, strictly in accordance with the CONTRACT CLAUSES, and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of this contract. The data package shall also include the following:

- (1) Identification of programmable portions of system equipment and capabilities.
- (2) Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.
- (3) Provision of operational software data on all modes of programmable portions of the fire alarm and detection system.
- (4) Description of Fire Alarm Control Panel equipment operation.
- (5) Description of auxiliary and remote equipment operations.
- (6) Library of application software.
- (7) Operation and maintenance manuals as specified in SD-19 of the Submittals paragraph.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt, dust, and any other contaminants.

PART 2 PRODUCTS

2.1 CONTROL PANEL

Control Panel shall comply with the applicable requirements of UL 864. Panel shall be modular, installed in a flush mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly assembled panel containing components and equipment required to provide the specified operating and supervisory

functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for LED/LCDs, zones, SLC, controls, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. The LED/LCD displays shall be located on the exterior of the cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means (single operation) shall be provided for testing the control panel visual indicating devices (meters or LEDs/LCDs). Meters and LEDs shall be plainly visible when the cabinet door is closed. Signals and LEDs/LCDs shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Each IDC shall be powered and supervised so that a signal on one zone does not prevent the receipt of signals from other devices. Loss of power, including batteries, shall not require the manual reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals. Visual annunciation shall be provided for LED/LCD visual display as an integral part of the control panel and shall identify with a word description and id number each device. Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate units. Cabinets shall be painted red .

2.1.1.1 Remote System Audible/Visual Display

Audible appliance shall have a minimum sound level output rating of 85 dBA at 3.05 m and operate in conjunction with the panel integral display. The audible device shall be silenced by a system silence switch on the remote system. The audible device shall be silenced by the system silence switch located at the remote location, but shall not extinguish the visual indication. The remote LED/LCD visual display shall provide identification, consisting of the word description and id number for each device as displayed on the control panel. A rigid plastic, phenolic or metal identification sign which reads "Fire Alarm System Remote Display" shall be provided at the remote audible/visual display. The remote visual appliance located with the audible appliance shall not be extinguished until the trouble or alarm has been cleared.

2.1.1.2 Circuit Connections

Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each conductor and terminal marked for identification.

2.1.1.3 System Expansion and Modification Capabilities

Any equipment and software needed by qualified technicians to implement future changes to the fire alarm system shall be provided as part of this contract.

2.1.4 Addressable Control Module

The control module shall be capable of operating as a relay (dry contact form C) for interfacing the control panel with other systems, and to control door holders or initiate elevator fire service. The module shall be UL listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Style Y notification appliance circuits. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. The control model shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled.

2.1.5 Addressable Initiating Device Circuits Module

The initiating device being monitored shall be configured as a Style B initiating device circuits. The system shall be capable of defining any module as an alarm module and report alarm trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling. The module shall be UL listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED.

2.2 STORAGE BATTERIES

Storage batteries shall be provided and shall be 24 Vdc sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 72 hours. Following this period of battery operation, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 15 minutes. Batteries shall be located at the bottom of the panel. Batteries shall be provided with overcurrent protection in accordance with NFPA 72. Separate battery cabinets shall have a lockable, hinged cover similar to the fire alarm panel. The lock shall be keyed the same as the fire alarm control panel. Cabinets shall be painted to match the fire alarm control panel.

2.3 BATTERY CHARGER

Battery charger shall be completely automatic, 24 Vdc with high/low charging rate, capable of restoring the batteries from full discharge (18 Volts dc) to full charge within 48 hours. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly, if a high rate switch is provided. Charger shall be located in control panel cabinet or in a separate battery cabinet.

2.4 ADDRESSABLE MANUAL FIRE ALARM STATIONS

Addressable manual fire alarm stations shall conform to the applicable requirements of UL 38. Manual stations shall be connected into signal line circuits. Stations shall be installed on semi-flush mounted outlet boxes. Manual stations shall be mounted at 1220 mm. Stations shall be double action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Addressable pull stations shall be capable of being field programmed, shall latch upon operation and remain latched until manually reset. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be matched and painted the same color as the fire alarm manual stations .

2.5 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, UL 268A, and UL 521. The detectors shall be provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors located in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD. Addressable fire detecting devices, except flame detectors, shall be dynamically supervised and uniquely identified in the control panel. All fire alarm initiating devices shall be individually addressable, except where indicated.

2.5.1 Heat Detectors

Heat detectors shall be designed for detection of fire by combination fixed temperature and rate-of-rise principle . Heat detector spacing shall be rated in accordance with UL 521. Detectors located in areas subject to moisture, exterior atmospheric conditions, as defined by NFPA 70 , shall be types approved for such locations. Heat detectors located in attic spaces or similar concealed spaces below the roof shall be intermediate temperature rated.

2.5.1.1 Combination Fixed-Temperature and Rate-of-Rise Detectors

Detectors shall be designed for semi-flush outlet box mounting and supported independently of wiring connections. Contacts shall be self-resetting after response to rate-of-rise principle. Under fixed temperature actuation, the detector shall have a permanent external indication which is readily visible. Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes shall operate on fixed temperature principle only. The UL 521 test rating for the fixed temperature portion shall be 57.2 degrees C. The UL 521 test rating for the Rate-of-Rise detectors shall be rated for 15 by 15 m.

2.5.1.2 Rate Compensating Detectors

Detectors shall be surface mounted horizontal type, with outlet box supported independently of wiring connections. Detectors shall be hermetically sealed and automatically resetting. Rate Compensated detectors shall be rated for 15 by 15 m.

2.5.1.3 Fixed Temperature Detectors

Detectors shall be designed for semi-flush outlet box mounting and supported independently of wiring connections. Detectors shall be designed to detect high heat. The detectors shall have a specific temperature setting of 57.2 degrees C. The UL 521 test rating for the fixed temperature detectors shall be rated for 4.57 by 4.57 m.

2.5.2 Smoke Detectors

Smoke detectors shall be designed for detection of abnormal smoke densities. Smoke detectors shall be photoelectric type. Detectors shall contain a visible indicator LED/LCD that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making wiring connections. Detectors that are to be installed in concealed (above false ceilings, etc.) locations shall be provided with a remote indicator LED/LCD suitable for mounting in a finished, visible location.

2.5.2.1 Ionization Detectors

Ionization detectors with a dual chamber shall be responsive to both invisible and visible particles of combustion. One chamber shall be a reference chamber and the second a sampling chamber. Detectors containing radium shall not be provided. Detectors shall not cause an alarm condition due to anticipated fluctuations in relative humidity. The sensitivity of the detector shall be field adjustable to compensate for operating conditions. Detector shall require no replacement or readjustment to restore it to normal operation after an alarm condition. Each detector shall be capable of withstanding ambient air velocity up to 1.5 meters per second in accordance with UL 268. Addressable smoke detectors shall be capable of having the sensitivity being remotely adjusted by the control panel.

2.5.2.2 Duct Detectors

Duct-mounted photoelectric smoke detectors shall be furnished and installed where indicated and in accordance with NFPA 90A. Units shall consist of a smoke detector as specified in paragraph Photoelectric Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have a manual reset. Detectors shall be rated for air velocities that include air flows between 2.5 and 20 m/s. Detectors shall be powered from the fire alarm panel. Sampling tubes shall run the full width of the duct. The duct detector package shall conform to the requirements of NFPA 90A, UL 268A, and shall be UL listed for use in air-handling systems. The

control functions, operation, reset, and bypass shall be controlled from the fire alarm control panel. Lights to indicate the operation and alarm condition; and the test and reset buttons shall be visible and accessible with the unit installed and the cover in place. Detectors mounted above 1.83 m and those mounted below 1.83 m that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test and reset switches. Remote lamps and switches as well as the affected fan units shall be properly identified in etched plastic placards. Detectors shall have auxiliary contacts to provide control, interlock, and shutdown functions specified in Section 1595 1A DIRECT DIGITAL CONTROL FOR HVAC. The detectors shall be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

2.5.3 Combination Smoke and Heat Detectors

Combination smoke and heat detectors shall have an audible device (self-contained) and be designed for detection of abnormal smoke densities by the photoelectric principle and abnormal heat by a fixed temperature sensor. Smoke detectors shall be provided with an LED light source. Failure of the LED shall not cause an alarm condition and the sensitivity shall be factory set at a nominal 3 percent and require no field adjustments of any kind. Heat detector portion shall be fixed temperature sensor rated at 57 degrees C. The audible appliances shall have a minimum sound output of at least 85 dBA at 3.05 m. Detectors shall contain a visible indicator LED that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Heat detectors shall connect to a control panel and shall be self restorable.

2.6 NOTIFICATION APPLIANCES

Audible appliances shall conform to the applicable requirements of UL 464. Devices shall be connected into notification appliance circuits. Devices shall have a separate screw terminal for each conductor. Audible appliances shall generate a unique audible sound from other devices provided in the building and surrounding area. Surface mounted audible appliances shall be painted red. Recessed audible appliances shall be installed with a grill that is painted with a factory finish to match the surface to which it is mounted.

2.6.1 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box surface mounted grille and vibrating type suitable for use in an electrically supervised circuit. Horns shall produce a sound rating of at least 85 dBA at 3.05 m. Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles.

2.6.2 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and the contract drawings. Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light. Strobe flash rate shall be between 1 to 3 flashes per second and a minimum of 75

candela. Strobe shall be semi-flush mounted.

2.6.3 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. Units shall be factory assembled. Any other audible notification appliance employed in the fire alarm systems shall be approved by the Contracting Officer.

2.7 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

2.7.1 Conduit

Conduit and fittings shall comply with NFPA 70, UL 6, UL 1242, and UL 797.

2.7.2 Wiring

Wiring shall conform to NFPA 70. Wiring for 120 Vac power shall be No. 12 AWG minimum. The SLC wiring shall be copper cable in accordance with the manufacturers requirements. Wiring for fire alarm dc circuits shall be No. 14 AWG minimum. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except that rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. T-tapping using screw terminal blocks is allowed for style 5 addressable systems.

2.7.3 Special Tools and Spare Parts

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the Contracting Officer. Two spare fuses of each type and size required shall be furnished. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished. Spare fuses shall be mounted in the fire alarm panel.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as shown, and in accordance with NFPA 70 and NFPA 72, and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until construction is essentially complete and the building has been thoroughly cleaned.

3.1.1.1 Power Supply for the System

A single dedicated circuit connection for supplying power from a branch circuit to each building fire alarm system shall be provided. The power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked in red with the words "FIRE ALARM CIRCUIT CONTROL".

3.1.1.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. Not more than two conductors shall be installed under any device screw terminal. The wires under the screw terminal shall be straight when placed under the terminal then clamped in place under the screw terminal. The wires shall be broken and not twisted around the terminal. Circuit conductors entering or leaving any mounting box, outlet box enclosure, or cabinet shall be connected to screw terminals with each terminal and conductor marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors in the system is prohibited. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

3.1.1.3 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 300 mm nor more than 2000 mm above the finished floor. Manually operable controls shall be between 900 and 1100 mm above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

3.1.1.4 Detectors

Detectors shall be located and installed in accordance with NFPA 72. Detectors shall be connected into signal line circuits or initiating device circuits as indicated on the drawings. Detectors shall be at least 300 mm from any part of any lighting fixture. Detectors shall be located at least 900 mm from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in open space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 900 mm, sway bracing shall be provided.

3.1.1.5 Notification Appliances

Notification appliances shall be mounted 2003 mm above the finished floor or 150 mm below the ceiling, whichever is lower.

3.1.6 Annunciator Equipment

Annunciator equipment shall be mounted where indicated on the drawings.

3.1.7 Addressable Initiating Device Circuits Module

The initiating device circuits module shall be used to connect supervised conventional initiating devices (water flow switches, water pressure switches, manual fire alarm stations, high/low air pressure switches, and tamper switches). The module shall mount in an electrical box adjacent to or connected to the device it is monitoring and shall be capable of Style B supervised wiring to the initiating device. In order to maintain proper supervision, there shall be no T-taps allowed on style B lines.

Addressable initiating device circuits modules shall monitor only one initiating device each. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform supervisory and alarm functions as specified in NFPA 72, as indicated on the drawings and as specified herein.

3.1.8 Addressable Control Module

Addressable and control modules shall be installed in the outlet box or adjacent to the device they are controlling. If a supplementary suppression releasing panel is provided, then the monitor modules shall be mounted in a common enclosure adjacent to the suppression releasing panel and both this enclosure and the suppression releasing panel shall be in the same room as the releasing devices. All interconnecting wires shall be supervised unless an open circuit or short circuit abnormal condition does not affect the required operation of the fire alarm system. If control modules are used as interfaces to other systems, such as HVAC or elevator control, they shall be within the control panel or immediately adjacent to it. Control modules that control a group of notification appliances shall be adjacent to the first notification appliance in the notification appliance circuits. Control modules that connect to devices shall supervise the notification appliance circuits. Control modules that connect to auxiliary systems or interface with other systems (non-life safety systems) and where not required by NFPA 72, shall not require the secondary circuits to be supervised. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform required alarm functions as specified in NFPA 72, as indicated on the drawings and as specified herein.

3.2 OVERVOLTAGE AND SURGE PROTECTION

3.2.1 Power Line Surge Protection

All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. Fuses shall not be used for surge protection. The surge protector shall be rated for a maximum let thru voltage of 350 Volts ac (line-to-neutral) and 350 Volt ac (neutral-to-ground).

3.2.2 Low Voltage DC Circuits Surge Protection

All IDC, NAC, and communication cables/conductors, except fiber optics, shall have surge protection installed at each point where it exits or enters a building. Equipment shall be protected from surges per IEEE C62.41

B3 combination waveform and NFPA 70. The surge protector shall be rated to protect the 24 Volt dc equipment. The maximum dc clamping voltages shall be 36 V (line-to-ground) and 72 Volt dc (line-to-line).

3.2.3 Signal Line Circuit Surge Protection

All SLC cables/conductors, except fiber optics, shall have surge protection/isolation circuits installed at each point where it exits or enters a building. The circuit shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. The surge protector/isolator shall be rated to protect the equipment.

3.3 GROUNDING

Grounding shall be provided by connecting to building ground system.

3.4 TESTING

The Contractor shall notify the Contracting Officer at least 10 days before the preliminary and acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise tests. The Contractor shall furnish instruments and personnel required for the tests.

3.4.1 Preliminary Tests

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance, when required. Tests shall include the meggering of system conductors to determine that the system is free from grounded, shorted, or open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional. After completing the preliminary testing the Contractor shall complete and submit the NFPA 72, Certificate of Completion.

3.4.2 Acceptance Test

Acceptance testing shall not be performed until the Contractor has completed and submitted the Certificate of Completion. Testing shall be in accordance with NFPA 72. The recommended tests in NFPA 72 shall be considered mandatory and shall verify that previous deficiencies have been corrected. The Contractor shall complete and submit the NFPA 72, Inspection and Testing Form. The test shall include all requirements of NFPA 72 and the following:

- a. Test of each function of the control panel.

- b. Test of each circuit in both trouble and normal modes.
- c. Tests of each alarm initiating devices in both normal and trouble conditions.
- d. Tests of each control circuit and device.
- e. Tests of each alarm notification appliance.
- f. Tests of the battery charger and batteries.
- g. Complete operational tests under emergency power supply.
- h. Visual inspection of wiring connections.
- i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.
- j. Ground fault
- k. Short circuit faults
- l. Stray voltage
- m. Loop resistance

3.5 TRAINING

Training course shall be provided for the operations and maintenance staff.

The course shall be conducted in the building where the system is installed or as designated by the Contracting Officer. The training period for systems operation shall consist of 1 training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The training period for systems maintenance shall consist of 2 training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The instructions shall cover items contained in the operating and maintenance instructions. In addition, training shall be provided on performance of expansions or modifications to the fire detection and alarm system. The training period for system expansions and modifications shall consist of at least 1 training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests.

-- End of Section --

SECTION 13920A

FIRE PUMPS
01/04

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1999) Liquid Chlorine
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA EWW	(1998) Standard Methods for the Examination of Water and Wastewater
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices

ASME INTERNATIONAL (ASME)

ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings

ASTM INTERNATIONAL (ASTM)

ASTM A 183	(2003) Carbon Steel Track Bolts and Nuts
ASTM A 193/A 193M	(2003) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 449	(2000) Quenched and Tempered Steel Bolts and Studs
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings

ASTM A 795	(2000) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 135M	(2000e1) Seamless Brass Tube (Metric)
ASTM B 42	(2002) Seamless Copper Pipe, Standard Sizes
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM D 3308	(2001) PTFE Resin Skived Tape
ASTM F 436M	(2003) Hardened Steel Washers (Metric)

FM GLOBAL (FM)

FM P7825a	(2003) Approval Guide Fire Protection
FM P7825b	(2003) Approval Guide Electrical Equipment

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1998) Motors and Generators
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 20	(2003) Installation of Stationary Pumps for Fire Protection
NFPA 70	(2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 448	(1994; Rev thru May 1999) Pumps for Fire-Protection Service
UL Fire Prot Dir	(2003) Fire Protection Equipment Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Requirements; G
Three copies of the Fire Pump Installation Drawings consisting of a detailed plan view, detailed elevations and sections of the pump room, equipment and piping, drawn to a scale of not less than 1:20. Drawings shall indicate equipment, piping, and associated pump

equipment to scale. All clearance, such as those between piping and equipment; between equipment and walls, ceiling and floors; and for electrical working distance clearance around all electrical equipment shall be indicated. Drawings shall include a legend identifying all symbols, nomenclatures, and abbreviations. Drawings shall indicate a complete piping and equipment layout including elevations and/or section views of the following:

- a. Fire pumps, controllers, piping, valves, and associated equipment.
- b. Sensing line for each pump including the pressure maintenance pump.
- c. Restraint of exterior water main at entry-point to the building including details of pipe clamps, tie rods, mechanical retainer glands, and thrust blocks.
- d. A one-line schematic diagram indicating layout and sizes of all piping, devices, valves and fittings.
- e. A complete point-to-point connection drawing of the pump power, control and alarm systems, as well as interior wiring schematics of each controller.

As-Built Drawings

As-built drawings, as specified.

SD-03 Product Data

Fire Pump Installation Related Submittals

A list of the Fire Pump Installation Related Submittals, no later than 7 days after the approval of the Fire Protection Specialist and the Manufacturer's Representative.

Installation Requirements; G

Manufacturer's catalog data included with the Fire Pump Installation Drawings for each separate piece of equipment proposed for use in the system. Catalog data shall indicate the name of the manufacturer of each item of equipment, with data annotated to indicate model to be provided. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided. Catalog data for material and equipment shall include, but not be limited to, the following:

- a. Fire pumps, drivers and controllers including manufacturer's certified shop test characteristic curve for each pump. Shop test curve may be submitted after approval of catalog data but shall be submitted prior to the final tests.
- b. Pressure maintenance pump and controller.

- c. Piping components.
- d. Valves, including gate, check, globe and relief valves.
- e. Gauges.
- f. (Not Required)
- g. (Not Required)
- h. (Not Required)
- i. Associated devices and equipment.

Spare Parts

Spare parts data for each different item of material and equipment specified.

Preliminary Test

Proposed procedures for Preliminary Tests, at least 14 days prior to the proposed start of the tests.

Proposed date and time to begin Preliminary Tests, submitted with the Preliminary Tests Procedures.

Field Tests; G

Proposed diagrams, at least 2 weeks prior to start of related testing.

Fire Protection Specialist; G

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the fire pump installation drawings.

Manufacturer's Representative; G

The name and documentation of certification of the proposed Manufacturer's Representative, concurrent with submittal of the Fire Protection Specialist Qualifications.

Field Training; G

Proposed schedule for field training submitted at least 14 days prior to the start of related training.

Final Acceptance Test

Proposed date and time to begin Final Acceptance Test, submitted

with the Final Acceptance Test Procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

Proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests.

SD-06 Test Reports

Preliminary Test; G

Three copies of the completed Preliminary Tests Reports, no later than 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist and the Manufacturer's Representative.

Final Acceptance Test; G

Three copies of the completed Final Acceptance Tests Reports, no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist and the Manufacturer's Representative. Test reports in booklet form (each copy furnished in a properly labeled three ring binder) showing all field tests and measurements taken during the preliminary and final testing, and documentation that proves compliance with the specified performance criteria, upon completion of the installation and final testing of the installed system. Each test report shall indicate the final position of the controls and pressure switches. The test reports shall include the description of the hydrostatic test conducted on the piping and flushing of the suction and discharge piping. A copy of the manufacturer's certified pump curve for each fire pump shall be included in the report.

SD-07 Certificates

Fire Protection Specialist; G

Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the fire pump installation is in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.

SD-10 Operation and Maintenance Data

Fire Pumps

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days prior to field training. The manuals shall include the

manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing a response to a service call on an emergency basis.

1.3 GENERAL REQUIREMENTS

a. Except as modified in this Section or on the drawings, fire pumps shall be installed in conformance with NFPA 20, including all recommendations and advisory portions, which shall be considered mandatory. All reference to the authority having jurisdiction shall be interpreted to mean the Contracting Officer.

b. The Contractor shall submit Spare Parts data for each different item of equipment and material specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

1.4 SEQUENCE OF OPERATION

1.4.1 Primary Fire Pump

Primary fire pump shall automatically operate when the pressure drops to 758 kPa. The fire pump shall automatically stop operating when the system pressure reaches 862 kPa and after the fire pump has operated for the minimum pump run time specified herein.

1.4.1.1 Pressure Maintenance Pump

Pressure maintenance pump shall operate when the system pressure drops to 793 kPa. Pump shall automatically stop when the system pressure reaches 862 kPa and after the pump has operated for the minimum pump run time specified herein.

1.4.2 Safety Requirements

Coupling, rotating parts, gears, projecting equipment, etc. shall be fully enclosed or properly guarded so as to prevent possible injury to persons that come in close proximity of the equipment. The Contractor shall conduct testing of the fire pumps in a safe manner and ensure that all equipment is safely secured. Hoses and nozzles used to conduct flow tests shall be in excellent condition and shall be safely anchored and secured to prevent any misdirection of the hose streams.

1.5 COORDINATION OF TRADES

Supports, piping offsets, fittings, and any other accessories required

shall be furnished as specified to provide a complete installation and to eliminate interference with other construction.

1.6 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed with protection from the weather, excessive humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall be either capped or plugged until installed.

1.7 FIELD MEASUREMENTS

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.8 FIRE PROTECTION SPECIALIST

Work specified in this section shall be performed under the supervision of and certified Fire Protection Specialist by Danish Standards. The Fire Protection Specialist shall be an individual who is a registered professional engineer. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.9 MANUFACTURER'S REPRESENTATIVE

Work specified in this section shall be performed under the supervision of and certified by a representative of the fire pump manufacturer. The Manufacturer's Representative shall be regularly engaged in the installation of the type and complexity of fire pump(s) specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.10 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years

prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number. Pumps and motors shall have standard nameplates securely affixed in a conspicuous place and easy to read. Fire pump shall have nameplates and markings in accordance with UL 448. Electric motor nameplates shall provide the minimum information required by NFPA 70, Section 430-7.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

2.4 UNDERGROUND/OUTSIDE PIPING COMPONENTS

2.4.1 Pipe and Fittings

Piping outside the building walls shall comply with Section 02510A WATER DISTRIBUTION SYSTEM.

2.5 ABOVEGROUND PIPING COMPONENTS

2.5.1 Pipe Sizes 65 mm and Larger

2.5.1.1 Pipe

Piping shall be ASTM A 795, Weight Class STD (Standard), Schedule 40 (except for Schedule 30 for pipe sizes 200 mm and greater in diameter), Type E or Type S, Grade A; black steel pipe. Steel pipe shall be joined by means of flanges welded to the pipe or mechanical grooved joints only. Piping shall not be jointed by welding or weld fittings. Suction piping shall be galvanized on the inside per NFPA 20.

2.5.1.2 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.5.1.3 Flanges

Flanges shall be ASME B16.5, Class 150 flanges. Flanges shall be provided at valves, connections to equipment, and where indicated.

2.5.1.4 Gaskets

Gaskets shall be AWWA C111, cloth inserted red rubber gaskets.

2.5.1.5 Bolts

Bolts shall be ASTM A 449, Type 1 . Bolts shall extend no less than three full threads beyond the nut with bolts tightened to the required torque.

2.5.1.6 Nuts

Nuts shall be ASTM A 193/A 193M, Grade 5 .

2.5.1.7 Washers

Washers shall meet the requirements of ASTM F 436M . Flat circular washers shall be provided under all bolt heads and nuts.

2.5.2 Piping Sizes 50 mm and Smaller

2.5.2.1 Steel Pipe

Steel piping shall be ASTM A 795, Weight Class STD (Standard), Schedule 40, Type E or Type S, Grade A, zinc-coated steel pipe with threaded end connections. Fittings shall be ASME B16.39, Class 150, zinc-coated threaded fittings. Unions shall be ASME B16.39, Class 150, zinc-coated unions.

2.5.2.2 Copper Tubing

Copper tubing shall be ASTM B 88M , Type L or K, soft annealed. Fittings shall be ASME B16.26, flared joint fittings. Pipe nipples shall be ASTM B 42 copper pipe with threaded end connections.

2.5.3 Pipe Hangers and Supports

Pipe hangers and support shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b and shall be the adjustable type. Finish of rods, nuts, washers, hangers, and supports shall be zinc-plated after fabrication.

2.5.4 Valves

Valves shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire protection service. Valves shall have flange or threaded end connections.

2.5.4.1 Gate Valves and Control Valves

Gate valves and control valves shall be outside screw and yoke (O.S.&Y.) type which open by counterclockwise rotation. Butterfly-type control valves are not permitted.

2.5.4.2 Tamper Switch

The suction control valves, the discharge control valves, and the by-pass control valves shall be equipped with valve tamper switches for monitoring by the fire alarm system.

2.5.4.3 Check Valve

Check valve shall be clear open, swing type check valve with flange or threaded inspection plate.

2.5.4.4 Relief Valve

Relief valve shall be spring operated type conforming to NFPA 20. A means of detecting water motion in the relief lines shall be provided where the discharge is not visible within the pump house.

2.5.4.5 Circulating Relief Valve

An adjustable circulating relief valve shall be provided for each fire pump in accordance with NFPA 20.

2.6 FIRE PUMP

Fire pump shall be electric motor driven . Pump capacity shall be rated at 100 liters per second with a rated net pressure of 56 kPa . Fire pump shall furnish not less than 150 percent of rated flow capacity at not less than 65 percent of rated net pressure. Pump shall be centrifugal vertical turbine in-line fire pump. The maximum rated pump speed shall be 2100 rpm when driving the pump at rated capacity. Pump shall conform to the requirements of UL 448. Fire pump discharge and suction gauges shall be oil-filled type.

2.7 ELECTRIC MOTOR DRIVER

Motor shall conform to NEMA MG 1 and be marked as complying with NEMA Design B standards. Motor wattage shall be of sufficient size so that the nameplate wattage rating will not be exceeded throughout the entire published pump characteristic curve. The motor and fire pump controller shall be fully compatible.

2.8 FIRE PUMP CONTROLLER

2.8.1 Controller for Electric Motor Driven Fire Pump

Controller shall be electronic soft start starting type. Controller shall be designed as indicated. Alarms shall be individually displayed in front of panel by lighting of visual lamps. Each lamp shall be labeled with rigid etched plastic labels. Controller shall be equipped with terminals for remote monitoring of pump running, pump power supply trouble (loss of power or phase and phase reversal), and pump room trouble (pump room temperature), and for remote start. Limited service fire pump controllers are permitted. Controller shall require the pumps to run for ten minutes for pumps with driver motors under 149 kW , prior to automatic shutdown.

The controller shall be equipped with an externally operable isolating switch which manually operates the motor circuit. Means shall be provided in the controller for measuring current for all motor circuit conductors.

2.9 PRESSURE SENSING LINE

A completely separate pressure sensing line shall be provided for each fire pump and for the jockey pump. The sensing line shall be arranged in accordance with Figure A-7-5.2.1. of NFPA 20. The sensing line shall be 15 mm H58 brass tubing complying with ASTM B 135M. The sensing line shall be equipped with two restrictive orifice unions each. Restricted orifice unions shall be ground-face unions with brass restricted diaphragms drilled for a 2.4 mm . Restricted orifice unions shall be mounted in the horizontal position, not less than 1.5 m apart on the sensing line. Two test connections shall be provided for each sensing line. Test connections shall consist of two brass 15 mm globe valves and 8 mm gauge connection tee arranged per NFPA 20. One of the test connections shall be equipped with a 0 to 1380 kPa water oil-filled gauge. Sensing line shall be connected to the pump discharge piping between the discharge piping control valve and the check valve.

2.10 PRESSURE MAINTENANCE PUMP

Pressure maintenance pump shall be electric motor driven, in-line vertical shaft, centrifugal type with a rated discharge of 0.63 liters per second at 862 kPa. Pump shall draft from the suction supply side of the suction pipe gate valve of the fire pump and shall discharge into the system at the downstream side of the pump discharge gate valve. An approved indicating gate valve of the outside screw and yoke (O.S.&Y.) type shall be provided in the maintenance pump discharge and suction piping. Oil-filled water pressure gauge and approved check valve in the maintenance pump discharge piping shall be provided. Check valve shall be swing type with removable inspection plate.

2.10.1 Pressure Maintenance Pump Controller

Pressure maintenance pump controller shall be arranged for automatic and manual starting and stopping and equipped with a "manual-off-automatic" switch. The controller shall be completely prewired, ready for field connections, and wall-mounted in a NEMA Type 2 drip-proof enclosure. The controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments for automatic starting and stopping. A sensing line shall be provided connected to the pressure maintenance pump discharge piping between the control valve and the check valve. The sensing line shall conform to paragraph, PRESSURE SENSING LINE. The sensing line shall be completely separate from the fire pump sensing lines. An adjustable run timer shall be provided to prevent frequent starting and stopping of the pump motor. The run timer shall be set for 2 minutes.

2.11 PUMP BASE PLATE AND PAD

For vertical shaft pumps, pump head shall be provided with a cast-iron base plate and shall serve as the sole plate for mounting the discharge head

assembly. Pump units and bases shall be mounted on a raised 100 mm reinforced concrete pad that is an integral part of the reinforced concrete floor.

2.12 PIPE SLEEVE

A pipe sleeve shall be provided at each location where piping passes through walls, ceilings, roofs, and floors, including pipe entering buildings from the exterior. Sleeves shall be grouted in position during construction. Sleeve shall be of sufficient length to pass through the entire thickness of the wall, ceilings, roofs and floors. The space between the exterior surface of the pipe and the interior surface of the sleeve shall be firmly packed with mineral wool insulation and caulk at both ends with plastic waterproof cement which will dry to a firm but pliable mass, or with a segmented elastomeric seal. Where pipes pass through fire walls or fire floors, a fire seal shall be provided between the pipe and the sleeve in accordance with Section 07840 FIRESTOPPING. Sleeves in masonry and concrete walls, ceiling, roofs and floors shall be hot-dip galvanized steel, ductile-iron, or cast-iron. Other sleeves shall be galvanized steel sheet pipe not less than 4.4 kg per square meter .

2.13 ESCUTCHEON (WALL) PLATES

Escutcheon plates shall be one-piece or split-hinge type metal plates and shall be provided for piping passing through floors, walls, and ceiling in exposed areas. In finished areas, plates shall be polished stainless steel or chromium-plated finish on copper alloy. In unfinished areas, plates shall have painted finish. Plates shall be secured in position.

2.14 DISINFECTING MATERIALS

2.14.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.14.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

PART 3 EXECUTION

3.1 FIRE PUMP INSTALLATION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation the fire pump(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall inspect the fire pump installation periodically assure that the installation conforms to the contract requirements. The Fire Protection Specialist shall perform a thorough

inspection of the fire pump installation, including visual observation of the pump while running shall be conducted. There shall be no excessive vibration, leaks (oil or water), unusual noises, overheating, or other potential problems. Inspection shall include piping and equipment clearance, access, supports, and guards. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered. The Fire Protection Specialist shall witness the preliminary and final acceptance tests and, after completion of the inspections and a successful final acceptance test, shall sign test results and certify in writing that the installation the fire pump installation is in accordance with the contract requirements.

3.3 INSTALLATION REQUIREMENTS

Installation, workmanship, fabrication, assembly, erection, examination, inspection and testing shall be in accordance NFPA 20, except as modified herein. In addition, the fire pump and engine shall be installed in accordance with the written instructions of the manufacturer.

3.4 PIPE AND FITTINGS

Piping shall be inspected, tested and approved before burying, covering, or concealing. Fittings shall be provided for changes in direction of piping and for all connections. Changes in piping sizes shall be made using tapered reducing pipe fittings. Bushings shall not be used.

3.4.1 Cleaning of Piping

Interior and ends of piping shall be clean and free of any water or foreign material. Piping shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of the piping shall be securely closed so that no water or foreign matter will enter the pipes or fittings. Piping shall be inspected before placing in position.

3.4.2 Threaded Connections

Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape conforming to ASTM D 3308 and shall be applied to male threads only. Exposed ferrous pipe threads shall be provided with one coat of zinc molybdate primer applied to a minimum of dry film thickness of 0.025 mm .

3.4.3 Pipe Hangers and Supports

Additional hangers and supports shall be provided for concentrated loads in aboveground piping, such as for valves and risers.

3.4.3.1 Vertical Piping

Piping shall be supported at each floor, at not more than 3 meters intervals.

3.4.3.2 Horizontal Piping

Horizontal piping supports shall be spaced as follows:

MAXIMUM SPACING (METERS)

Nominal Pipe Size (mm)	25 and Under	32	40	50	65	80	90	100	125	150+
Steel Pipe	2	2.4	2.7	3	3.3	3.6	3.9	4.2	4.8	5.0

3.4.4 Grooved Mechanical Joint

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.5 ELECTRICAL WORK

Electric motor and controls shall be in accordance with NFPA 20 and NFPA 70, unless more stringent requirements are specified herein or are indicated on the drawings. Electrical wiring and associated equipment shall be provided in accordance with NFPA 20 and Section 16415A ELECTRICAL WORK, INTERIOR.

3.6 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09900 PAINTING, GENERAL.

3.7 FLUSHING

The fire pump suction and discharge piping shall be flushed at 120 percent of rated capacity of each pump. The new pumps may be used to attain the required flushing volume. Flushing operations shall continue until water is clear, but not less than 10 minutes. The Contractor shall submit a signed and dated flushing certificate before requesting field testing.

3.8 FIELD TESTS

The Contractor shall submit, at least 2 weeks before starting field tests, system diagrams that show the layout of equipment, piping, and storage

units, and typed condensed sequence of operation, wiring and control diagrams, and operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

3.8.1 Hydrostatic Test

Piping shall be hydrostatically tested at 1551 kPa for a period of 2-hours, or at least 345 kPa in excess of the maximum pressure, when the maximum pressure in the system is in excess of 1207 kPa .

3.8.2 Preliminary Test

The Fire Protection Specialist shall take all readings and measurements. The Manufacturer's Representative, a representative of the fire pump controller manufacturer, and a representative of the diesel engine manufacturer (when supplied) shall witness the complete operational testing of the fire pump and drivers. The fire pump controller manufacturer's representative and the diesel engine manufacturer's representative shall each be an experienced technician employed by the respective manufacturers and capable of demonstrating operation of all features of respective components including trouble alarms and operating features. Fire pumps, drivers and equipment shall be thoroughly inspected and tested to insure that the system is correct, complete, and ready for operation. Tests shall ensure that pumps are operating at rated capacity, pressure and speed. Tests shall include manual starting and running to ensure proper operation and to detect leakage or other abnormal conditions, flow testing, automatic start testing, testing of automatic settings, sequence of operation check, test of required accessories; test of pump alarms devices and supervisory signals, test of pump cooling, operational test of relief valves, and test of automatic power transfer, if provided. Pumps shall run without abnormal noise, vibration or heating. If any component or system was found to be defective, inoperative, or not in compliance with the contract requirements during the tests and inspection, the corrections shall be made and the entire preliminary test shall be repeated.

3.8.3 Final Acceptance Test

The Fire Protection Specialist shall take all readings and measurements. The Manufacturer's Representative, the fire pump controller manufacturer's representative, and the diesel engine manufacturer's representative (when supplied) shall also witness for the final tests. The Contractor shall be responsible for repairing any damage caused by hose streams or other aspects of the test. The final acceptance test shall include the following:

3.8.3.1 Flow Tests

Flow tests using the most remote standpipe hose valve, hoses and playpipe nozzles shall be conducted. Flow tests shall be performed at churn (no flow), 75, 100, 125 and 150 percent capacity for each pump and at full capacity of the pump installation. Flow readings shall be taken from each nozzle by means of a calibrated pitot tube with gauge or other approved

measuring equipment. Rpm, suction pressure and discharge pressure reading shall be taken as part of each flow test. Voltage and ampere readings shall taken on each phase as part of each flow test for electric-motor driven pumps.

3.8.3.2 Starting Tests

Pumps shall be tested for automatic starting and sequential starting. Setting of the pressure switches shall be tested when pumps are operated by pressure drop. Tests may be performed by operating the test connection on the pressure sensing lines. As a minimum, each pump shall be started automatically 10 times and manually 10 times, in accordance with NFPA 20. The fire pumps shall be operated for a period of a least 10 minutes for each of the starts; except that electric motors over 149 kW shall be operated for at least 15 minutes and shall not be started more than 2 times in 10 hours. Pressure settings that include automatic starting and stopping of the fire pump(s) shall be indicated on an etched plastic placard, attached to the corresponding pump controller.

3.8.3.3 Alarms

All pump alarms, both local and remote, shall be tested.

3.8.3.4 Miscellaneous

Valve tamper switches shall be tested. Pressure recorder operation relief valve settings, valve operations, operation and accuracy of gauges, and other accessory devices shall be verified.

3.8.4 Correction of Deficiencies

If equipment was found to be defective or non-compliant with contract requirements, the Contractor shall performed corrective actions and repeat the tests.

3.8.5 Test Equipment

The Contractor shall provide all equipment and instruments necessary to conduct a complete final test, including 65 mm diameter hoses, playpipe nozzles, pitot tube gauges, portable digital tachometer, voltage and ampere meters, and calibrated oil-filled water pressure gauges. The Contractor shall provide all necessary supports to safely secure hoses and nozzles during the test. The Government will furnish water for the tests.

3.8.6 Test Documentation (use test applicable to this type of installation)

The Manufacturer's Representative shall supply a copy of the manufacturer's certified curve for each fire pump at the time of the test. The Fire Protection Specialist shall record all test results and plot curve of each pump performance during the test. Complete pump acceptance test data of each fire pump shall be recorded. The pump acceptance test data shall be on forms that give the detail pump information such as that which is indicated in Figure A-11-2.6.3(f) of NFPA 20. All test data records shall be submitted in a three ring binder.

3.8.7 As-Built Drawings

The Contractor shall submit As-Built Drawings, no later than 14 days after completion of the Final Tests. The Fire Pump Installation Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be on reproducible full-size mylar film.

3.9 DISINFECTION

After all system components are installed including pumps, piping, and other associated work, and all hydrostatic test(s) are successfully completed, thoroughly flush the pumps and all piping to be disinfected with potable water until there is no visible sign of dirt or other residue. and hydrostatic test are successfully completed, each portion of the piping specified in this Section system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.10 FIELD TRAINING

The Fire Protection Specialist and the Manufacturer's Representative shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 8 hours of normal working time and shall start after the fire pump installation is functionally complete and after the Final Acceptance Test. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

SECTION 13930A

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION
01/04

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1015	(1999) Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies
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AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1999) Liquid Chlorine
AWWA C606	(1997) Grooved and Shouldered Joints
AWWA C651	(1999) Disinfecting Water Mains
AWWA C652	(2002) Disinfection of Water-Storage Facilities
AWWA EWW	(1998) Standard Methods for the Examination of Water and Wastewater

ASME INTERNATIONAL (ASME)

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.11	(2002) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(2002) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2002) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.1	(1996) Square and Hex Bolts and Screws, Inch Series
ASME B18.2.2	(1987; R 1999) Square and Hex Nuts

ASTM INTERNATIONAL (ASTM)

ASTM A 135	(2001) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(2003) Carbon Steel Track Bolts and Nuts
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 795	(2000) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 62	(2002) Composition Bronze or Ounce Metal Castings
ASTM B 75M	(1999) Seamless Copper Tube (Metric)
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM D 2000	(2001) Rubber Products in Automotive Applications
ASTM F 436M	(2003) Hardened Steel Washers (Metric)

FM GLOBAL (FM)

FM P7825a	(2003) Approval Guide Fire Protection
FM P7825b	(2003) Approval Guide Electrical Equipment

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-71 (1997) Gray Iron Swing Check Valves,
Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2003) Life Safety Code

NFPA 13 (2002) Installation of Sprinkler Systems

NFPA 13D (2002) Installation of Sprinkler Systems
in One- and Two-Family Dwellings and
Manufactured Homes

NFPA 13R (2002) Installation of Sprinkler Systems
in Residential Occupancies Up to and
Including Four Stories in Height

NFPA 24 (2002) Installation of Private Fire
Service Mains and Their Appurtenances

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (2003) Building Materials Directory

UL Fire Prot Dir (2003) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

Wet pipe sprinkler system shall be provided in all areas of the building . The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13 and NFPA 13R. Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation. The Contractor shall design any portions of the sprinkler system that are not indicated on the drawings including locating sprinklers, piping and equipment, and size piping and equipment when this information is not indicated on the drawings or is not specified herein. The design of the sprinkler system shall be based on hydraulic calculations, and the other provisions specified herein.

1.2.1 Hydraulic Design

The system shall be hydraulically designed to discharge a minimum density of 4.1 L/min per square meter over the hydraulically most demanding 280 square meters of floor area. The minimum pipe size for branch lines in gridded systems shall be 32 mm . Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13. Water velocity in the piping shall not exceed 6 m/s .

1.2.1.1 Hose Demand

An allowance for interior hose stations of 378 L/min shall also be added to the sprinkler system demand.

1.2.1.2 Basis for Calculations

The design of the system shall be based upon a water supply with a static pressure of 620 kPa, and a flow of 57/ps at a residual pressure of 331 kPa.

Water supply shall be presumed available at the point of connection to existing . Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping. Hydraulic calculations shall be based on operation of the fire pump provided in Section 13920A FIRE PUMPS

1.2.2 Sprinkler Coverage

Sprinklers shall be uniformly spaced on branch lines. In buildings protected by automatic sprinklers, sprinklers shall provide coverage throughout 100 percent of the building except bathroom under 55 sq.ft. and closet space under 24 sq.ft.. This includes, but is not limited to, telephone rooms, electrical equipment rooms, mechanical rooms, switchgear rooms, transformer rooms, and other electrical and mechanical spaces. Coverage per sprinkler shall be in accordance with NFPA 13R, but shall not exceed 9 square m for extra hazard occupancies, 12 square m for ordinary hazard occupancies, and 21 square m for light hazard occupancies.

Exceptions are as follows:

1) Facilities that are designed in accordance with NFPA 13R and NFPA 13D.

2) Sprinklers may be omitted from small rooms which are exempted for specific occupancies in accordance with NFPA 101.

1.3 COORDINATION OF TRADES

Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction. Sprinkler shall be installed over and under ducts, piping and platforms when such equipment can negatively effect or disrupt the sprinkler discharge pattern and coverage.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings; G

Three copies of the Sprinkler System Shop Drawings, no later than 21 days prior to the start of sprinkler system installation.

As-Built Drawings

As-built shop drawings, at least 14 days after completion of the Final Tests. The Sprinkler System Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be on reproducible full-size mylar film.

SD-03 Product Data

Fire Protection Related Submittals

A list of the Fire Protection Related Submittals, no later than 7 days after the approval of the Fire Protection Specialist.

Materials and Equipment; G

Manufacturer's catalog data included with the Sprinkler System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations; G

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

Spare Parts

Spare parts data shall be included for each different item of material and equipment specified.

Preliminary Tests; G

Proposed procedures for Preliminary Tests, no later than 14 days prior to the proposed start of the tests. Proposed date and time

to begin the preliminary tests.

Final Acceptance Test; G

Proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests. Proposed date and time to begin Final Acceptance Test, submitted with the Final Acceptance Test Procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

On-site Training; G

Proposed On-site Training schedule, at least 14 days prior to the start of related training.

Fire Protection Specialist; G

The name and documentation of certification of the proposed Fire Protection Specialists per Danish Standards, no later than 14 days after the Notice to Proceed and prior to the submittal of the sprinkler system drawings and hydraulic calculations.

Sprinkler System Installer; G

The name and documentation of certification of the proposed Sprinkler System Installer per Danish Standards, concurrent with submittal of the Fire Protection Specialist Qualifications.

SD-06 Test Reports

Preliminary Test Report; G

Three copies of the completed Preliminary Test Report, no later than 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping.

All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist.

Final Acceptance Test Report; G

Three copies of the completed Final Acceptance Tests Reports, no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist.

SD-07 Certificates

Inspection by Fire Protection Specialist; G

Concurrent with the Final Acceptance Test Report, certification

by the Fire Protection Specialist that the sprinkler system is installed in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing a response to a service call on an emergency basis.

1.7 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Software that uses k-factors for typical branch lines is not acceptable. Calculations shall be based on the water supply data shown on the drawings. Calculations shall substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.8 FIRE PROTECTION SPECIALIST

Work specified in this section shall be performed under the supervision of a certified Fire Protection Specialist by Danish Standards. The Fire Protection Specialist shall be an individual who is a registered professional engineer. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner

intended for a period of not less than 6 months.

1.9 SPRINKLER SYSTEM INSTALLER

Work specified in this section shall be performed by the Sprinkler System Installer. The Sprinkler System Installer shall be regularly engaged in the installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.10 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.11 SPARE PARTS

The Contractor shall submit spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

1.12 SHOP DRAWINGS

The Sprinkler System Shop Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

- a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.
- b. Floor plans drawn to a scale not less than 1:100 which clearly show locations of sprinklers, risers, pipe hangers, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.
- c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or

ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b

2.4 UNDERGROUND/OUTSIDE PIPING COMPONENTS

2.4.1 Pipe

Piping from a point 150 mm above the floor to the point of connection to the existing water mains shall be as indicated on civil drawings and specifications. Piping outside the building walls shall comply with Section 02510A WATER DISTRIBUTION SYSTEM.

2.5 ABOVEGROUND PIPING COMPONENTS

Aboveground piping shall be steel or copper .

2.5.1 Steel Piping Components

2.5.1.1 Steel Pipe

Except as modified herein, steel pipe shall be black as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A 795, ASTM A 53/A 53M, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.5.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.5.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa service and shall be the product of the same manufacturer; segmented welded fittings shall not be used. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.5.1.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1.6 mm thick, and full face or self-centering flat ring type.

2.5.1.5 Bolts, Nut, and Washers

Bolts shall be squarehead conforming to ASME B18.2.1, and shall extend no less than three full threads beyond the nut with bolts tightened to the required torque. Nuts shall be hexagon type conforming to ASME B18.2.2. Washers shall meet the requirements of ASTM F 436M. Flat circular washers shall be provided under all bolt heads and nuts.

2.5.2 Copper Tube Components

2.5.2.1 Copper Tube

Copper tube shall conform to ASTM B 88M, Types L and M.

2.5.2.2 Copper Fittings and Joints

Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18 and wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B 75M. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B 62. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used. Grooved mechanical joints and fittings shall be designed for not less than 862 kPa service and shall be the product of the same manufacturer. Grooved fitting and mechanical coupling housing shall be ductile iron conforming to ASTM A 536. Gaskets for use in grooved joints shall be molded synthetic polymer of pressure responsive design and

shall conform to ASTM D 2000 for circulating medium up to 110 degrees C . Grooved joints shall conform to AWWA C606. Coupling nuts and bolts for use in grooved joints shall be steel and shall conform to ASTM A 183.

2.5.3 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b and of the type suitable for the application, construction, and pipe type and sized to be supported.

2.5.4 Valves

2.5.4.1 Control Valve and Gate Valve

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b.

2.5.4.2 Check Valve

Check valve 50 mm and larger shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b. Check valves 100 mm and larger shall be of the swing type with flanged cast iron body and flanged inspection plate, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.5.4.3 Hose Valve

See Section 13975N STANDPIPE SYSTEMS.

2.6 WATERFLOW ALARM

Electrically operated, exterior-mounted, waterflow alarm bell shall be provided and installed in accordance with NFPA 13. Waterflow alarm bell shall be rated 24 VDC and shall be connected to the Fire Alarm Control Panel(FACP) in accordance with Section 13851A FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE

2.7 ALARM INITIATING AND SUPERVISORY DEVICES

2.7.1 Sprinkler Waterflow Indicator Switch, Vane Type

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 38 L/min or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall be tamper resistant and contain two SPDT (Form C) contacts arranged to transfer upon removal of the housing cover, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

2.7.2 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.8 SPRINKLERS

Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed coverage limitations. Temperature classification shall be ordinary. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13.

2.8.1 Semi-Recessed Sprinkler

Sprinkler shall be white polyester quick-response type and shall have a nominal 12.7 mm or 13.5 mm orifice.

2.8.2 Upright Sprinkler

Upright sprinkler shall be brass and shall have a nominal 12.7 mm or 13.5 mm orifice.

2.9 DISINFECTING MATERIALS

2.9.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.9.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

2.10 ACCESSORIES

2.10.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

2.10.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 20 mm and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.10.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished

chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

2.10.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers located in mechanical rooms.

2.10.5 Identification Sign

Valve identification sign shall be minimum 150 mm wide x 50 mm high with enamel baked finish on minimum 1.214 mm steel or 0.6 mm aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

2.11 DOUBLE-CHECK VALVE BACKFLOW PREVENTION ASSEMBLY

Double-check backflow prevention assembly shall comply with ASSE 1015. The assembly shall have a bronze, cast-iron or stainless steel body with flanged ends. The assembly shall include pressure gauge test ports and OS&Y shutoff valves on the inlet and outlet, 2-positive-seating check valve for continuous pressure application, and four test cocks. Assemblies shall be rated for working pressure of 1034 kPa. The maximum pressure loss shall be 40 kPa at a flow rate equal to the sprinkler water demand, at the location of the assembly. A test port for a pressure gauge shall be provided both upstream and downstream of the double check backflow prevention assembly valves.

PART 3 EXECUTION

3.1 FIRE PROTECTION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation of the sprinkler systems(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein.

3.3 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall inspect the sprinkler system periodically during the installation to assure that the sprinkler system is being provided and installed in accordance with the contract requirements. The Fire Protection Specialist shall witness the preliminary and final tests, and shall sign the test results. The Fire Protection Specialist, after completion of the system inspections and a successful final test,

shall certify in writing that the system has been installed in accordance with the contract requirements. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

3.4 ABOVEGROUND PIPING INSTALLATION

3.4.1 Piping in Exposed Areas

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

3.4.2 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.4.3 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 25 mm pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 300 mm. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling shall not extend more than 25 mm below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 100 mm. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area.

3.4.3.1 Pendent Sprinkler Locations

Pendent sprinklers in suspended ceilings shall be a minimum of 150 mm from ceiling grid.

3.4.4 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 750 mm in length shall be individually supported.

3.4.5 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site.

Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings and grooving tools shall be products of the same manufacturer. For copper tubing, pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.4.6 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 15 mm (.

3.4.7 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section 07840 FIRESTOPPING. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.4.8 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.4.9 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 25 mm pipe connected at the riser as a combination test and drain valve; a test valve

located approximately 2 meters above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located in the janitor's closet and piped to discharge into the mop receptor.

3.4.10 Drains

Main drain piping shall be provided to discharge at the location indicated. Auxiliary drains shall be provided as required by NFPA 13.

3.4.11 Installation of Fire Department Connection

Connection shall be mounted on the exterior wall approximately 900 mm above finished grade. The piping between the connection and the check valve shall be provided with an automatic drip in accordance with NFPA 13 and arranged to drain to the outside.

3.4.12 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.5 UNDERGROUND PIPING INSTALLATION

Piping outside the building walls shall meet the requirements of Section 02510A WATER DISTRIBUTION SYSTEM.

3.6 ELECTRICAL WORK

Except as modified herein, electric equipment and wiring shall be in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 13851A FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE.

All wiring for supervisory and alarm circuits shall be #14 AWG solid copper installed in metallic tubing or conduit. Wiring color code shall remain uniform throughout the system.

3.7 DISINFECTION

After all system components are installed and hydrostatic test(s) are successfully completed, each portion of the sprinkler system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. Flushing shall be conducted by removing the flushing fitting of the cross mains and of the grid branch lines, and then back-flushing through the sprinkler main drains. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid

chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained. After successful completion, verify installation of all sprinklers and plugs and pressure test the system.

3.8 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09900 PAINTS AND COATINGS.

3.9 PRELIMINARY TESTS

The system, including the exterior water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The aboveground interior and exterior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

3.9.1 Aboveground Piping

3.9.1.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 1400 kPa or 350 kPa in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.9.1.2 Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly shall be tested at system flow demand, including all applicable hose streams, as specified in NFPA 13. The Contractor shall provide all equipment and instruments necessary to conduct a complete forward flow test, including 65 mm diameter hoses, playpipe nozzles, calibrated pressure gauges, and pitot tube gauge. The Contractor

shall provide all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction) across the assembly shall be recorded. A metal placard shall be provided on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate. The pressure drop shall be compared to the manufacturer's data.

3.9.2 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

3.9.3 Main Drain Flow Test

Following flushing of the exterior piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.10 FINAL ACCEPTANCE TEST

Final Acceptance Test shall begin only when the Preliminary Test Report has been approved. The Fire Protection Specialist shall conduct the Final Acceptance Test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received. The Contractor shall submit the Final Acceptance Test Report as specified in the Submittals paragraph.

3.11 ON-SITE TRAINING

The Fire Protection Specialist shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 2 hours of normal working time and shall start after the system is functionally complete and after the Final Acceptance Test. The On-Site Training shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

SECTION 13975N

STANDPIPE SYSTEMS

02/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C651 (1999) Disinfecting Water Mains

ASTM INTERNATIONAL (ASTM)

ASTM C 1036 (2001) Flat Glass

FM GLOBAL (FM)

FM P7825 (2003) Approval Guide

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13 (2002) Installation of Sprinkler Systems

NFPA 14 (2003) Installation of Standpipe, Private Hydrants and Hose Systems

NFPA 24 (2002) Installation of Private Fire Service Mains and Their Appurtenances

NFPA 70 (2002) National Electrical Code

NFPA 72 (2002) National Fire Alarm Code

UNDERWRITERS LABORATORIES (UL)

UL Fire Prot Dir (2003) Fire Protection Equipment Directory

1.2 RELATED REQUIREMENTS

Section 15050A BASIC MECHANICAL MATERIALS AND METHODS applies to this section with additions and modifications specified herein.

1.3 SYSTEM DESCRIPTION

Design and provide new combination, automatic, wet Class III standpipe and fire sprinkler system as shown.

1.4 SYSTEM DESCRIPTION

System design and manufacturer's products shall be in accordance with the required and advisory provisions of NFPA 14 except as modified herein. Standpipe system shall be designed by hydraulic calculations. Provide sprinkler portion of system under Section 13930A WET-PIPE FIRE SUPPRESSION SPRINKLERS. Each system shall include materials, accessories, and equipment inside and outside the building necessary to provide each system complete and ready for use. Devices and equipment shall be UL Fire Prot Dir listed or FM P7825 approved for fire protection service. In the publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" shall be interpreted to mean the Fire Protection Specialist. The work shall begin at the points indicated.

1.4.1 Residual Pressure

The minimum residual pressure at the outlet of the most remote 65 mm hose connection shall be 689.5 kPa while the system is discharging at the required design flow rates.

1.4.2 Friction Losses

Calculate losses in piping in accordance with the Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.

1.4.3 Water Supply

Base hydraulic calculations on a static pressure of 620 kPa with 571 L/m available at a residual pressure of 331 kPa at the junction with the existing water distribution piping system.

1.4.4 Standpipe System Drawings

Prepare in accordance with the requirements for "Plans and Specifications" as specified in NFPA 14. Each drawing shall be A1 841 by 594 mm. Plans shall be drawn to a scale not less than 1 mm equals 100 mm. Do not commence work until the design of each system and the various components have been approved. Show data essential for proper installation of each system. Show details, plan view, elevations, and sections of the systems supply and piping. Show piping schematic of systems supply, devices, valves, pipe, and fittings. Submit drawings signed by a registered fire protection specialist. Show:

- a. Room, space or area layout and include pipe supports and hangers.
- b. Field wiring diagrams showing locations of devices and points of connection and terminals used for all electrical field connections in the system, with wiring color code scheme.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

The fire protection specialist, Engineering Field Activity will review any approve all submittals in this section requiring Government approval.

SD-02 Shop Drawings

Standpipe system; G

SD-03 Product Data

Aboveground Pipe and fittings; G

Mechanical couplings; G

Pipe hangers and supports; G

Valves, including gate, check, and hose; G

Fire department connections; G

Waterflow detector; G

Fire hose cabinets; G

Valve tamper switch; G

Data which describes more than one type of item shall be clearly marked to indicate which type the Contractor intends to provide. Submit one original for each item and clear, legible, first-generation photocopies for the remainder of the specified copies. Incomplete or illegible photocopies will not be accepted. Partial submittals will not be accepted.

SD-06 Test Reports

Preliminary tests; G

Acceptance tests; G

Submit for all inspections and tests specified under paragraph entitled "Field Quality Control."

SD-07 Certificates

Qualifications of installer; G

Submit installers qualifications as required under paragraph entitled "Qualifications of Installer."

SD-11 Closeout Submittals

System as-built drawings; G

1.6 QUALITY ASSURANCE

1.6.1 Qualifications of Installer

Prior to commencing work, submit data showing that the Contractor has successfully installed fire extinguishing standpipe systems of the same type and design as specified herein, or that he has a firm contractual agreement with a subcontractor having the required experience. Include the names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate the type and design of each system, and certify that the system has performed satisfactorily for a period of at least 18 months.

Qualifications of System Technician: Installation drawings, shop drawing and as-built drawings shall be prepared, by or under the supervision of, an individual who is experienced with the types of works specified herein, and is currently certified by Danish Standards Contractor shall submit data for approval showing the name and certification of all involved individuals with such qualifications at or prior to submittal of drawings.

1.6.2 System As-Built Drawings

Upon completion, and before final acceptance of the work, submit a complete set of as-built drawings of each system. Submit A1 841 by 594 mm reproducible as-built drawings on mylar film with title block similar to full size contract drawings. Furnish as-built(record) working drawings in addition to the as-built drawings required by Division 1, "General Requirements."

1.7 DELIVERY, STORAGE AND HANDLING

Protect stored equipment from weather, humidity and temperature variations, dirt, dust, and other contaminants.

PART 2 PRODUCTS

2.1 ABOVEGROUND PIPING SYSTEMS

Provide fittings for changes in direction of piping and for connections. Make changes in piping sizes through tapered reducing pipe fittings; bushings will not be permitted. Perform welding in the shop; field welding will not be permitted. Conceal piping in areas with suspended ceiling.

2.1.1 Pipe and Fittings

NFPA 14, except as modified herein. Steel piping shall be Schedule 40 for sizes less than 200 mm, and Schedule 30 or 40 for sizes 200 mm and larger.

Fittings shall be welded, threaded, or grooved-end type. Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into the pipe when pressure is applied will not be permitted. Rubber gasketed grooved-end pipe and fittings with mechanical couplings shall be permitted in pipe sizes 40 mm and larger. Fittings shall be UL Fire Prot Dir listed or FM P7825 approved for use in wet pipe sprinkler systems. Fittings, mechanical couplings, and rubber gaskets shall be supplied by the same manufacturer. Steel piping with wall thickness less than Schedule 30 shall not be threaded. Side outlet tees using rubber gasketed fittings shall not be permitted. Pipe and fittings shall be metal.

2.1.2 Pipe Hangers and Supports

Provide in accordance with NFPA 14.

2.1.3 Valves

NFPA 14. Provide valves of types approved for fire service. Hose and gate valves shall open by counterclockwise rotation. Provide isolation and check valves as required by NFPA 14. Isolation valves shall be OS&Y type. Check valves shall be flanged clear opening swing-check type with flanged inspection and access cover plate for sizes 100 mm and larger.

2.1.3.1 Hose Valves

Provide bronze pressure regulating type hose valve with 65 mm National Standard male hose threads with cap and chain, and 65 mm male hose threads with 22.86 mm hose. Equip valve with a device to regulate pressure at the outlet to a pressure not exceeding 690 kPa under both flow and no-flow conditions.

2.1.4 Identification Signs

NFPA 14. Attach properly lettered and approved metal signs to each valve and alarm device.

2.1.5 Pipe Sleeves

Provide where piping passes entirely through walls, floors, roofs and partitions. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs and partitions. Provide one inch minimum clearance between exterior of piping and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of the sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with UL listed fill, void, or cavity material.

2.1.5.1 Sleeves in Masonry and Concrete Walls, Floors, and Roofs

Provide hot-dip galvanized steel, ductile-iron, or cast-iron sleeves. Core

drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth. Extend sleeves in floor slabs 76 mm above finished floors.

2.1.5.2 Sleeves in Partitions

Provide 26 gage galvanized steel sheet.

2.1.6 Escutcheon Plates

Provide one piece or split hinge type metal plates for piping passing through walls, floors, and ceilings in both exposed and concealed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces. Securely anchor plates in place.

2.1.7 Fire Department Connections

Provide connections approximately one meter above finish grade, of the approved two-way type with 65 mm National Standard female hose threads with plug, chain, and identifying fire department connection escutcheon plate.

2.1.8 Waterflow Detector

Provide vane-type waterflow detector. Provide detector with adjustable retard feature to prevent false alarms caused by momentary water surges. Connect into the building fire alarm system. Alarm actuating device shall have mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and shall instantly recycle. Provide detector at the base of each standpipe riser above main check valve in accordance with manufacturers instructions.

2.1.9 Fire Hose Cabinets

Provide semi recessed-mounted cabinets where indicated. Cabinets shall be prime grade, cold-rolled, reannealed, process-leveled, furniture steel. Fabricate cabinet from 20 gage steel and door and trim from 18 gage steel. Provide fully welded joints ground smooth. On each jamb, provide at least two anchors or reinforcements spaced approximately 610 mm apart for building in or attaching the cabinets to adjacent construction. Doors shall be flush hollow metal type with fully welded joints ground smooth and full glazed opening. Provide door with continuous hinge, latch and pull. Hinge door for 180 degree opening. Glass shall conform to ASTM C 1036 and shall be Type II, Class 1 (clear), Quality q 8 (glazing quality), 6.35 mm thick. Factory finish cabinet inside and out with one coat of enamel applied over a primer. Interior finish color shall be white. Exterior finish color shall be red. Fabricate cabinet with sufficient interior space to store one _____ mm hose made of 100% synthetic double jacket and synthetic rubber lining, FM LABEL. Coordinate nozzle and threads with user.

2.1.10 Valve Tamper Switch

Provide valve tamper switch(es) to monitor the open position of valve(s)

controlling water supply to the standpipe system. Switch contacts shall transfer from the normal (valve open) position to the off-normal (valve closed) position during the first two revolutions of the hand wheel or when the stem of the valve has moved not more than one-fifth of the distance from its normal position. Switch shall be tamper resistant. Removal of the cover shall cause switch to operate into the off-normal position.

2.1.11 Fire Pumps

Provide as specified in Section 13920N FIRE PUMPS.

2.2 ELECTRICAL WORK

Provide electrical work associated with this section under Section 16402N INTERIOR DISTRIBUTION SYSTEM, except for fire alarm wiring. Provide fire alarm wiring and connection to fire alarm systems under Section this section in accordance with NFPA 70 and NFPA 72.

PART 3 EXECUTION

3.1 CONNECTIONS TO EXISTING WATER SUPPLY SYSTEMS

Connections to existing water supply system are specified in Section 02510A WATER DISTRIBUTION.

3.2 STANDPIPE SYSTEM INSTALLATION

Equipment, materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with the NFPA standards referenced herein. Install piping straight and true to bear evenly on hangers and supports. Conceal piping to the maximum extent possible. Piping shall be inspected, tested and approved before being concealed. Provide fittings for changes in direction of piping and for all connections. Make changes in piping sizes through standard reducing pipe fittings; do not use bushings. Cut pipe accurately and work into place without springing or forcing. Ream pipe ends and free pipe and fittings from burrs. Clean with solvent to remove all varnish and cutting oil prior to assemble. Make screw joints with PTFE tape applied to male thread only.

3.3 DISINFECTION

Disinfect new water piping from the point of connection at the water main and existing water piping affected by the Contractor's operation in accordance with AWWA C651. Exercise caution when mixing chlorine disinfectant solutions. Fill piping systems with solution containing minimum of 50 parts per million of free available chlorine and allow solution to stand for a minimum of 24 hours. Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 parts per million. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit results prior to new water piping being placed into service.

3.4 FIELD PAINTING

Field painting of fire extinguishing standpipe system shall be specified in Section 09900 PAINTS AND COATINGS. Field painting requirements for "Fire Extinguishing Sprinkler Systems" shall apply.

3.4.1 Piping Labels

Provide permanent labels in mechanical rooms, spaced at 6 meters maximum intervals along pipe, indicating "STANDPIPE."

3.5 ELECTRICAL WORK

Provide electrical work associated with this section under Section 16402N INTERIOR DISTRIBUTION SYSTEM, except for fire alarm wiring. Provide fire alarm wiring and connection to fire alarm systems under Section this section in accordance with NFPA 70 and NFPA 72.

3.6 FLUSHING

Flush the piping system with potable water in accordance with NFPA 14. Continue flushing operation until water is clear, but for not less than 10 minutes.

3.7 FIELD QUALITY CONTROL

Prior to initial operation, inspect equipment and piping systems for compliance with drawings, specifications, and manufacturer's submittals. Perform tests in the presence of the Contracting Officer to determine conformance with the specified requirements.

3.7.1 Preliminary Tests

Each piping system shall be hydrostatically tested at 1379 kPa (gage) in accordance with NFPA 14 and NFPA 24 and shall show no leakage or reduction in gauge pressure after 2 hours. The Contractor shall conduct complete preliminary tests, which shall encompass all aspects of system operation. Individually test alarms, and all other components and accessories to demonstrate proper functioning. Test water flow alarms by flowing water. When tests have been completed and all necessary corrections made, submit to the Contracting Officer a signed and dated certificate, similar to that specified in NFPA 13, attesting to the satisfactory completion of all testing and stating that the system is in operating condition. Also include a written request for a formal inspection and test.

3.7.2 Formal Inspection and Tests (Acceptance Tests)

The Fire Protection Specialist, will witness formal tests and approve all systems before they are accepted. The system shall be considered ready for such testing only after all necessary preliminary tests have been made and all deficiencies found have been corrected to the satisfaction of the Contracting Officer and written certification to this effect is received by the Division Fire Protection Specialist. Submit the request for formal inspection at least 15 working days prior to the date the inspection is to

take place. Experienced technicians regularly employed by the Contractor in the installation of both the mechanical and electrical portions of such systems shall be present during the inspection and shall conduct the testing. All instruments, personnel, appliances and equipment for testing shall be furnished by the Contractor. The Government will furnish water for the tests. All necessary tests encompassing all aspects of system operation shall be made including the following, and any deficiency found shall be corrected and the system retested at no cost to the Government.

3.7.2.1 Flow Test

Perform flow tests of each standpipe riser in accordance with NFPA 14. Affix 0-1379 kPa pressure gauges to lowest hose valve and next-to-highest hose valve. Connect lined, 65 mm diameter fire hose with underwriter's playpipe to highest hose valve and flow at least 946 L/m for 5 minutes from standpipe to a safe location outside the building. Furnish hose, nozzles and fittings required for this test.

3.7.2.2 Alarm Testing

- a. Each pressure switch, waterflow detector, and water gong shall be activated by flow of water.
- b. Each valve tamper switch shall be activated by partially closing the associated control valve.
- c. Alarm annunciation at the fire alarm control panel shall be verified.
- d. Circuit supervision shall be demonstrated.

3.7.3 Additional Tests

When deficiencies, defects or malfunctions develop during the tests required, all further testing of the system shall be suspended until proper adjustments, corrections or revisions have been made to assure proper performance of the system. If these revisions require more than a nominal delay, the Contracting Officer shall be notified when the additional work has been completed, to arrange a new inspection and test of the system. All tests required shall be repeated prior to final acceptance, unless directed otherwise.

-- End of Section --

SECTION 15080A

THERMAL INSULATION FOR MECHANICAL SYSTEMS
07/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

At the discretion of the Government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

ASTM INTERNATIONAL (ASTM)

ASTM A 580/A 580M	(1998) Stainless Steel Wire
ASTM B 209M	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM C 1136	(2003) Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 195	(2000) Mineral Fiber Thermal Insulating Cement
ASTM C 449/C 449M	(2000) Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 552	(2000e1) Cellular Glass Thermal Insulation
ASTM C 553	(2002) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 591	(2001) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 647	(1995; R 2000) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM C 795	(1992; R 1998e1) Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C 916	(1985; R 2001e1) Adhesives for Duct

Thermal Insulation

ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM C 921	(2003a) Jackets for Thermal Insulation
ASTM E 84	(2003) Surface Burning Characteristics of Building Materials
ASTM E 96	(2000e1) Water Vapor Transmission of Materials

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-69	(2002) Pipe Hangers and Supports - Selection and Application
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MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

MICA Insulation Stds	(1999) National Commercial & Industrial Insulation Standards
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1.2 SYSTEM DESCRIPTION

Field-applied insulation and accessories on mechanical systems shall be as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated. Insulation of heat distribution systems outside of buildings shall be as specified in Section 02554AABOVEGROUND HEAT DISTRIBUTION SYSTEM. Field applied insulation materials required for use on Government-furnished items as listed in the SPECIAL CONTRACT REQUIREMENTS shall be furnished and installed by the Contractor.

1.3 GENERAL QUALITY CONTROL

1.3.1 Standard Products

Materials shall be the standard products of manufacturers regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.3.2 Installer's Qualifications

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.3.3 Surface Burning Characteristics

Unless otherwise specified, insulation not covered with a jacket shall have a flame spread index no higher than 75 and a smoke developed index no higher than 150. Insulation systems which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Insulation

materials located exterior to the building perimeter are not required to be fire-rated. Flame spread, and smoke developed indexes, shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Material supplied by a manufacturer with a jacket shall be tested as a composite material. Jackets, facings, and adhesives shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in accordance with ASTM E 84.

1.3.4 Identification of Materials

Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Mica Plates

After approval of materials and prior to applying insulation, a booklet shall be prepared and submitted for approval. The booklet shall contain marked-up MICA Insulation Stds plates (or detail drawings showing the insulation material and insulating system) for each pipe, duct, or piece of equipment that must be insulated per this specification. The MICA plates shall be marked up showing the materials to be installed in accordance with the requirements of this specification for the specific insulation application. The Contractor shall submit all MICA Plates required to show the entire insulating system, including Plates required to show insulation penetrations, vessel bottom and top heads, legs, and skirt insulation as applicable. If the Contractor elects to submit detailed drawings instead of marked-up MICA Plates, the detail drawings shall show cut-away, section views, and details indicating each component of the insulation system and showing provisions for insulating jacketing, and sealing portions of the equipment. For each type of insulation installation on the drawings, provide a label that identifies each component in the installation (i.e., the duct, insulation, adhesive, vapor retarder, jacketing, tape, mechanical fasteners, etc.) Indicate insulation by type and manufacturer. Three copies of the booklet shall be submitted at the jobsite to the Contracting Officer. One copy of the approved booklet shall remain with the insulation Contractor's display sample and two copies shall be provided for Government use.

SD-03 Product Data

General Materials

A complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories for each mechanical system requiring insulation shall be included. Materials furnished under this section of the specification shall be submitted at one time.

SD-04 Samples

Thermal Insulation Materials

After approval of materials actual sections of installed systems, properly insulated in accordance with the specification requirements, shall be displayed. Such actual sections must remain accessible to inspection throughout the job and will be reviewed from time to time for controlling the quality of the work throughout the construction site. Each material used shall be identified, by indicating on an attached sheet the specification requirement for the material and the material by each manufacturer intended to meet the requirement. The Contracting Officer will inspect display sample sections at the jobsite. Approved display sample sections shall remain on display at the jobsite during the construction period. Upon completion of construction, the display sample sections will be closed and sealed.

Pipe Insulation Display Sections: Display sample sections shall include as a minimum an elbow or tee, a valve, dielectric waterways and flanges, a hanger with protection shield and insulation insert, or dowel as required, at support point, method of fastening and sealing insulation at longitudinal lap, circumferential lap, butt joints at fittings and on pipe runs, and terminating points for each type of pipe insulation used on the job, and for hot pipelines and cold pipelines, even when the same type of insulation is used for these services.

1.5 STORAGE

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants. The Contracting Officer may reject insulation material and supplies that become dirty, dusty, wet, or contaminated by some other means.

PART 2 PRODUCTS

2.1 GENERAL MATERIALS

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or

dry state. Materials to be used on stainless steel surfaces shall meet ASTM C 795 requirements. Materials shall be asbestos free and conform to the following:

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Danish products may be used that have not been tested and certified by the standards and requirements listed in paragraph 1.1 of this section as long as the products are of true commercial quality and are safe for the intended use. Danish products shall meet all current, applicable, Danish safety codes, standards, and requirements.

2.1.1 Adhesives

2.1.1.1 Acoustical Lining Insulation Adhesive

Adhesive shall be a nonflammable, fire-resistant adhesive conforming to ASTM C 916, Type I.

2.1.1.2 Mineral Fiber Insulation Cement

Cement shall be in accordance with ASTM C 195.

2.1.1.3 Lagging Adhesive

Lagging is the material used for thermal insulation, especially around a cylindrical object. This may include the insulation as well as the cloth/material covering the insulation. Lagging adhesives shall be nonflammable and fire-resistant and shall have a flame spread rating no higher than 25 and a smoke developed rating no higher than 50 when tested in accordance with ASTM E 84. Adhesive shall be pigmented white and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bonding fibrous glass tape to joints of fibrous glass board; for bonding lagging cloth to thermal insulation; or for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations.

2.1.2 Contact Adhesive

Adhesives may be dispersed in a volatile organic solvent. Adhesives may be any of, but not limited to, the neoprane based, rubber based, or elastomeric type that have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in the dry state in accordance with ASTM E 84. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not emit nauseous, irritating, or

toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 100 degrees C. The dried adhesive shall be nonflammable and fire resistant. Natural cross-ventilation, local (mechanical) pickup, and/or general area (mechanical) ventilation shall be used to prevent an accumulation of solvent vapors, keeping in mind the ventilation pattern must remove any heavier-than-air solvent vapors from lower levels of the workspaces. Gloves and spectacle-type safety glasses are recommended in accordance with safe installation practices.

2.1.3 Caulking

ASTM C 920, Type S, Grade NS, Class 25, Use A.

2.1.4 Corner Angles

Nominal 0.4060 mm aluminum 25 x 25 mm with factory applied kraft backing. Aluminum shall be ASTM B 209M, Alloy 3003, 3105, or 5005.

2.1.5 Finishing Cement

ASTM C 449/C 449M: Mineral fiber hydraulic-setting thermal insulating and finishing cement. All cements that may come in contact with Austenitic stainless steel must include testing per ASTM C 795.

2.1.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth and glass tape shall have flame spread and smoke developed ratings of no greater than 25/50 when measured in accordance with ASTM E 84. Tape shall be 100 mm wide rolls.

2.1.7 Staples

Outward clinching type monel or ASTM A 167, Type 304 or 316 stainless steel. Monel is a nickel rich alloy that has high strength, high ductility, and excellent resistance to corrosion.

2.1.8 Jackets

ASTM C 921, Type I, maximum moisture vapor transmission 0.02 perms, (measured before factory application or installation), minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 6.1 N/mm width. ASTM C 921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 3.5 N/mm width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing. Based on the application, insulation materials that require factory applied jackets are mineral fiber, cellular glass, and phenolic foam. All non-metallic jackets shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84.

2.1.8.1 White Vapor Retarder All Service Jacket (ASJ)

For use on hot/cold pipes, ducts, or equipment vapor retarder jackets used

on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

2.1.8.2 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.4060 mm nominal thickness; ASTM B 209M, Temper H14, Temper H16, Alloy 3003, 5005, or 3105 with factory applied moisture retarder. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.3960 mm thick, 12.7 mm wide for pipe under 300 mm diameter and 19.1 mm (3/4 inch) wide for pipe over 300 mm and larger diameter. Aluminum jacket circumferential seam bands shall be 50.8 x 0.4060 mm aluminum matching jacket material. Bands for insulation below ground shall be 19.1 x 0.5080 mm thick stainless steel, or fiberglass reinforced tape. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburgh or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

2.1.8.3 Polyvinyl Chloride (PVC) Jackets

Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, UV resistant rating or treatment and moderate chemical resistance with minimum thickness 0.7620 mm.

2.1.9 Vapor Retarder Required

2.1.9.1 Vapor Retarder Mastic Coatings

The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall be determined according to procedure B of ASTM E 96 utilizing apparatus described in ASTM E 96. The coating shall be a nonflammable, fire resistant type. All other application and service properties shall be in accordance with ASTM C 647.

2.1.9.2 Laminated Film Vapor Retarder

ASTM C 1136, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where Type II, maximum moisture vapor transmission 0.02 perms, a minimum puncture resistance of 25 Beach units is acceptable.

2.1.10 Vapor Retarder Not Required

ASTM C 1136, Type III, maximum moisture vapor transmission 0.10 perms, minimum puncture resistance 50 Beach units on all surfaces except ductwork, where Type IV, maximum moisture vapor transmission 0.10, a minimum puncture resistance of 25 Beach units is acceptable.

2.1.11 Wire

Soft annealed ASTM A 580/A 580M Type 302, 304 or 316 stainless steel, 16 or

18 gauge.

2.1.12 Sealants

Sealants shall be chosen from the butyl polymer type, the styrene-butadiene rubber type, or the butyl type of sealants. Sealants shall have a maximum moisture vapor transmission of 0.02 perms, and a maximum flame spread/smoke developed index of 25/50 per ASTM E 84.

2.2 PIPE INSULATION MATERIALS

The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Pipe insulation materials shall be limited to those listed herein and shall meet the following requirements:

2.2.1 Interior Cold Pipeline

Insulation for minus 34 degrees to plus 16 degrees C for indoor, exposed or concealed applications, shall be as follows:

- a. "Rockwool" Firesafe stone wool insulation (or approved equal) with manufacturer's recommended factory applied jacket.

2.2.2 Interior Hot Pipeline

Insulation for above 16 degrees C, for indoor, exposed or concealed applications shall meet the following requirements. Supply the insulation with manufacturer's recommended factory-applied jacket.

- a. "Rockwool" Firesafe stone wool insulation (or approved equal) with manufacturer's recommended factory applied jacket.

2.3 DUCT INSULATION MATERIALS

Duct insulation materials shall be limited to those listed herein and shall meet the following requirements:

2.3.1 "Rockwool" Firesafe Stone Wool (or approved equal)

2.4 EQUIPMENT INSULATION MATERIALS

Equipment insulation materials shall be limited to those listed herein and shall meet the following requirements:

2.4.1 Hot Equipment Insulation

For equipment operating temperatures above 16 degrees C.

2.4.1.1 "Rockwool" Firesafe Stone Wool (or approved equal)

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

Insulation shall only be applied to unheated and uncooled piping and equipment. Insulation shall not be compressed at joists, studs, columns, ducts, hangers, etc.

3.1.1 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA Insulation Stds plates except where modified herein or on the drawings.

3.1.2 Fire-stopping

Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in Section 07840 FIRESTOPPING.

3.1.3 Painting and Finishing

Painting shall be as specified in Section 09900 PAINTS AND COATINGS.

3.1.4 Welding

No welding shall be done on piping, duct or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

3.1.5 Pipes/Ducts/Equipment which Require Insulation

Insulation is required on all pipes, ducts, or equipment, except for omitted items, as specified.

3.2 PIPE INSULATION INSTALLATION

3.2.1 Pipe Insulation

3.2.1.1 General

Pipe insulation shall be installed on interior hot and cold pipeline systems as specified below to form a continuous thermal retarder, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

- a. Pipe used solely for fire protection.
- b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.
- c. Sanitary drain lines.
- d. Air chambers.

3.2.1.2 Pipes Passing Through Walls, Roofs, and Floors

- a. Pipe insulation shall be continuous through the sleeve.
- b. An aluminum jacket with factory applied moisture retarder shall be provided over the insulation wherever penetrations require sealing.
- c. Where pipes penetrate interior walls, the aluminum jacket shall extend 50 mm beyond either side of the wall and shall be secured on each end with a band.
- d. Where penetrating interior floors, the aluminum jacket shall extend from a point below the backup material to a point 250 mm above the floor with one band at the floor and one not more than 25 mm from the end of the aluminum jacket.
- e. Where penetrating waterproofed interior floors, the aluminum jacket shall extend from below the backup material to a point 50 mm above the flashing with a band 25 mm from the end of the aluminum jacket.
- f. Where penetrating roofs, pipe shall be insulated as required for interior service to a point flush with the top of the flashing and sealed with vapor retarder coating. The insulation for exterior application shall butt tightly to the top of flashing and interior insulation. The exterior aluminum jacket shall extend 50 mm down beyond the end of the insulation to form a counter flashing. The flashing and counter flashing shall be sealed underneath with caulking.
- g. For hot water pipes supplying lavatories or other similar heated

service that requires insulation, the insulation shall be terminated on the backside of the finished wall. The insulation termination shall be protected with two coats of vapor barrier coating with a minimum total thickness of 2.0 mm applied with glass tape embedded between coats (if applicable). The coating shall extend out onto the insulation 50.0 mm and shall seal the end of the insulation. Glass tape seams shall overlap 25 mm . The annular space between the pipe and wall penetration shall be caulked with approved fire stop material. The pipe and wall penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration at least 10 mm .

- h. For domestic cold water pipes supplying lavatories or other similar cooling service that requires insulation, the insulation shall be terminated on the finished side of the wall (i.e., insulation must cover the pipe throughout the wall penetration). The insulation shall be protected with two coats of vapor barrier coating with a minimum total thickness of 2.0 mm . The coating shall extend out onto the insulation 50 mm and shall seal the end of the insulation. The annular space between the outer surface of the pipe insulation and the wall penetration shall be caulked with an approved fire stop material having vapor retarder properties. The pipe and wall penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration by at least 10 mm .

3.2.1.3 Pipes Passing Through Hangers

- a. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 50 mm and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 50 mm shall be installed.
- b. Horizontal pipes larger than 50 mm at 16 degrees C and above shall be supported on hangers in accordance with MSS SP-69, and Section 15400A PLUMBING, GENERAL PURPOSE.
- c. Horizontal pipes larger than 50 mm and below 16 degrees C shall be supported on hangers with the addition of a Type 40 protection shield in accordance with MSS SP-69. An insulation insert of ASTM C 552, Type II or Type III cellular glass, or the necessary strength ASTM C 591, Type I polyisocyanurate shall be installed above each shield. The insert shall cover not less than the bottom 180-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 50 mm on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 25 mm , wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the weight of the pipe from

crushing the insulation, as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert.

- d. Vertical pipes shall be supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with MSS SP-69 covering the 360-degree arc of the insulation. An insulation insert of ASTM C 552, Type II or Type III cellular glass or ASTM C 553, Type I calcium silicate shall be installed between each shield and the pipe. The insert shall cover the 360-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 50 mm on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 25 mm, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the hanger from crushing the insulation, as an option instead of installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 9 m, the weight of the pipe shall be additionally supported with hangers in the vertical run of the pipe that are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.
- e. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 38 mm, and shall be sealed as required for the pipe jacket.

3.2.1.4 Pipes in high abuse areas.

In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, welded PVC or aluminum jackets shall be utilized. Pipe insulation to the 1.8 m level shall be protected.

3.2.2 Aboveground Cold Pipelines

The following cold pipelines shall be insulated per Table I minus 34 degrees C to plus 16 degrees C:

- a. Domestic cold water.
- b. Make-up water.
- c. Exposed lavatory drains and domestic water lines serving plumbing fixtures for handicap persons.
- d. HVAC condensate drains

3.2.2.1 Insulation Thickness

Insulation thickness for cold pipelines shall be determined using Table I.

Table I - Cold Piping Insulation Thickness
Pipe Size (mm)

Type of Service	Material	Run-outs up to 42 mm*	21 mm & less	27 42 mm	48 - 114 mm	140 mm	169 mm & larger
Cold domestic water, above and below ceilings, & make up water	RW	40	40	40	40	40	40
Exposed lavatory drains and domestic water lines serving plumbing fixtures for handicap personnel	RW	30	30	30	40	50	50
HVAC condensate drain located inside building	RW		30	30	30	N/A	N/A

*When run-outs to terminal units exceed 3.66 m the entire length of run-out shall be insulated like the main feed pipe. Insulations may not be applied if their flame and smoke developed ratings exceed the requirements of 25/50 established in this guide specification. Layered insulations, or installation where multiple layers of the same insulation are used, must be checked for this (in particular if the insulation has been rated per ASTM E 84 for one thickness).

LEGEND:

RW - Rockwool

3.2.2.2 Jacket for Rockwool and Polyisocyanurate Foam Insulated Pipe

Insulation shall be covered with a factory applied vapor retarder jacket or field applied seal welded PVC jacket. Insulation inside the building, to be protected with an aluminum jacket, shall have the insulation and vapor retarder jacket installed as specified herein. The aluminum jacket shall be installed as specified for piping exposed to weather, except sealing of the laps of the aluminum jacket is not required. In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and

mechanical rooms, aluminum jackets shall be utilized. Pipe insulation to the 1.8 m level shall be protected.

3.2.2.3 Insulation for Straight Runs

- a. Insulation shall be applied to the pipe with joints tightly butted. All butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating or PVDC adhesive tape.
- b. Longitudinal laps of the jacket material shall overlap not less than 38 mm. Butt strips 75 mm wide shall be provided for circumferential joints.
- c. Laps and butt strips shall be secured with adhesive and stapled on 100 mm centers if not factory self-sealing. If staples are used, they shall be sealed per item "e." below. Note that staples are not required with cellular glass systems.
- d. Factory self-sealing lap systems may be used when the ambient temperature is between 4 degrees and 50 degrees C during installation. The lap system shall be installed in accordance with manufacturer's recommendations. Stapler shall be used only if specifically recommended by the manufacturer. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.
- e. All Staples, including those used to repair factory self-seal lap systems, shall be coated with a vapor retarder coating or PVDC adhesive tape. All seams, except those on factory self-seal systems shall be coated with vapor retarder coating or PVDC adhesive tape.
- f. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it with adhesive, stapling, and coating with vapor retarder coating or compatible adhesive tape. The patch shall extend not less than 38 mm past the break.
- g. At penetrations such as thermometers, the voids in the insulation shall be filled and sealed with vapor retarder coating or PVDC adhesive tape.

3.2.2.4 Insulation for Fittings and Accessories

- a. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating or PVDC adhesive tape.
- b. Precut or preformed insulation shall be placed around all fittings and accessories and shall conform to MICA plates except as modified herein: 5 for anchors; 10, 11, and 13 for fittings; 14 for valves; and 17 for flanges and unions. Insulation shall be

the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 50 mm or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow".

- c. Upon completion of insulation installation on flanges, unions, valves, anchors, fittings and accessories, terminations, seams, joints and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with PVDC adhesive tape or two coats of vapor retarder coating with a minimum total thickness of 2.0 mm, applied with glass tape embedded between coats. Tape seams shall overlap 25 mm. The coating shall extend out onto the adjoining pipe insulation 50 mm. Fabricated insulation with a factory vapor retarder jacket shall be protected with compatible adhesive tape or two coats of vapor retarder coating with a minimum thickness of 2 mm and with a 50 mm wide glass tape embedded between coats. Where fitting insulation butts to pipe insulation, the joints shall be sealed with a vapor retarder coating and a 100 mm wide ASJ tape which matches the jacket of the pipe insulation.
- d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 150 mm from the insulation surface.
- e. Insulation shall be marked showing the location of unions, strainers, and check valves.

3.2.2.5 Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory precut or premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same insulation as the pipe insulation including same density, thickness, and thermal conductivity. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

3.2.3 Aboveground Hot Pipelines

The following hot pipelines above 16 degrees C shall be insulated per Table II:

- a. Domestic hot water supply & re-circulating system.
- b. Steam.

c. Steam Condensate

d. Heating hot water, supply and return.

e. Glycol heating supply and return.3.2.3.1 Insulation Thickness

Insulation thickness for hot pipelines shall be determined using Table II.

LEGEND:

RW - Rockwool

Table II - Hot Piping Insulation Thickness
Pipe Size (mm)

Type of Service (degrees C)	Material	Run-outs up to 50 mm*	25 mm & less	32 - 50 mm	65 - 100 mm	125 - 150 mm	205 mm & larger
Hot domestic water supply & re-circulating system & Water defrost lines (93C max)**	RW	15	40	40	40	40	40
Steam & condensate return (94 C -121 C)	RW		40	40	50	50	65
Heating hot water, supply & return (121 C Max)	RW	15	40	40	50	65	80

* When run-outs to terminal units exceed 3.66 m, the entire length of run-out shall be insulated like the main feed pipe.

** Applied to re-circulating sections of service or domestic hot water systems and first 2.4 meters from storage tank for non-re-circulating systems.

3.2.3.2 Jacket for Insulated Hot Pipe

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type II jacket or field applied aluminum where required or seal welded PVC.

3.2.3.3 Insulation for Straight Runs

- a. Insulation shall be applied to the pipe with joints tightly butted.
- b. Longitudinal laps of the jacket material shall overlap not less than 38 mm, and butt strips 75 mm wide shall be provided for circumferential joints.
- c. Laps and butt strips shall be secured with adhesive and stapled on 100 mm centers if not factory self-sealing. Adhesive may be omitted where pipe is concealed.
- d. Factory self-sealing lap systems may be used when the ambient temperature is between 4 degrees and 49 degrees C and shall be installed in accordance with manufacturer's instructions. Laps and butt strips shall be stapled whenever there is non-adhesion of the system. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.
- e. Breaks and punctures in the jacket material shall be patched by either wrapping a strip of jacket material around the pipe and securing with adhesive and staple on 100 mm centers (if not factory self-sealing), or patching with tape and sealing with a brush coat of vapor retarder coating. Adhesive may be omitted where pipe is concealed. Patch shall extend not less than 38 mm past the break.

3.2.3.4 Insulation for Fittings and Accessories

- a. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories.
- b. Precut or preformed insulation shall be placed around all fittings and accessories and shall conform to MICA plates, except as modified herein: 5 for anchors; 10, 11, 12, and 13 for fittings; 14, 15 and 16 for valves; 17 for flanges and unions; and 18 for couplings. Insulation shall be the same as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 50 mm or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow".
- c. Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and insulation not protected by factory jackets or PVC fitting covers shall be protected with two coats of adhesive applied with glass tape embedded between coats. Tape seams shall overlap 25 mm. Adhesive shall extend onto the adjoining insulation not less than 50 mm. The total dry film thickness shall be not less than 2.0

mm.

- d. Insulation terminations shall be tapered to unions at a 45-degree angle.
- e. At the option of the Contractor, factory pre-molded one- or two-piece PVC fitting covers may be used in lieu of the adhesive and embedded glass tape. Factory pre-molded segments or factory or field cut blanket insert insulation segments shall be used under the cover and shall be the same thickness as adjoining pipe insulation. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding or with tacks made for securing PVC covers.

3.2.4 Piping Exposed to Weather

Piping exposed to weather shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, an aluminum jacket or PVC jacket shall be applied. PVC jacketing requires no factory-applied jacket beneath it, however an all service jacket shall be applied if factory applied jacketing is not furnished. Flexible elastomeric cellular insulation exposed to weather shall be treated in accordance with paragraph INSTALLATION OF FLEXIBLE ELASTOMERIC CELLULAR INSULATION.

3.2.4.1 Aluminum Jacket

The jacket for hot piping may be factory applied. The jacket shall overlap not less than 50 mm at longitudinal and circumferential joints and shall be secured with bands at not more than 300 mm centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 16 degrees C and below shall be sealed with caulking while overlapping to prevent moisture penetration. Where jacketing on piping 16 degrees C and below abuts an un-insulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 16 degrees C shall be sealed with a moisture retarder.

3.2.4.2 Insulation for Fittings

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of breather emulsion type weatherproof mastic (impermeable to water, permeable to air) recommended by the insulation manufacturer shall be applied with glass tape embedded between coats. Tape overlaps shall be not less than 25 mm and the adjoining aluminum jacket not less than 50 mm. Factory preformed aluminum jackets may be used in lieu of the above. Molded PVC fitting covers shall be provided when PVC jackets are used for straight runs of pipe. PVC fitting covers shall have adhesive welded joints and shall be weatherproof.

3.3 DUCT INSULATION INSTALLATION

Except for oven hood exhaust duct insulation, corner angles shall be installed on external corners of insulation on ductwork in exposed finished

spaces before covering with jacket.

3.3.1 Duct Insulation Thickness

Duct insulation thickness shall be in accordance with Table III.

Table III - Minimum Duct Insulation (mm)

Building Exhaust Ducts to Ventilation Units Inside Mechanical Rooms and Above 3rd Floor Ceiling	40
Exhaust Ducts from HVAC Equipment to Outside	50
Fresh Air Intake Ducts	*Note 1
Tempered Fresh Air Supply Ducts Inside Mechanical Rooms	50
Laundry Dryer Vent and Ducts up to within 3 m from the Outside	40
Laundry Dryer Vent and Ducts within 3m of the Outside	*Note 1
Common Area Range Hood Vent Duct up to within 3m of the Outside	40
Common Area Range Hood vent Duct within 3m of the Outside	*Note 1
Supply Ducts Above 3rd Floor Ceiling	40

*Note 1: Per insulation manufacturers recommendation.

3.3.2 Insulation and Vapor Retarder for Ducts Handling Cold Air

Insulation and vapor retarder shall be provided for ducts and associated equipment handling cold air.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 12 kg per cubic meter and rigid type where exposed, minimum density 48 kg per cubic meter. Insulation for round/oval ducts shall be flexible type, minimum density 12 kg per cubic meter with a factory Type I or II jacket; or, a semi rigid board, minimum density 48 kg per cubic meter, , formed or fabricated to a tight fit, edges beveled and joints tightly butted and staggered, with a factory applied Type I or II all service jacket. Insulation for exposed ducts shall be provided with either a white, paint-able, factory-applied Type I jacket or a vapor retarder jacket coating finish as specified. Insulation on concealed duct shall be provided with a factory-applied Type I or II vapor retarder jacket. The total dry film thickness shall be approximately 2.0 mm.. Duct insulation shall be continuous through sleeves and prepared openings except firewall penetrations. Duct insulation terminating at fire dampers, shall be continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air and which may be prone to condensate formation. Duct insulation and vapor retarder shall cover the collar, neck, and any un-insulated surfaces of diffusers, registers and grills. Vapor retarder materials shall be applied to form a complete unbroken vapor seal over the insulation. Sheet Metal Duct shall be sealed in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.3.2.1 Installation on Concealed Duct

- a. For rectangular, oval or round ducts, insulation shall be attached by applying adhesive around the entire perimeter of the duct in 150 mm wide strips on 300 mm centers.
- b. For rectangular and oval ducts, 600 mm and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 400 mm centers and not more than 400 mm from duct corners.
- c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 400 mm centers and not more than 400 mm from duct corners.
- d. Insulation shall be impaled on the mechanical fasteners (self stick pins) where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor retarder jacket joints overlap 50 mm. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hangers.
- e. Self-locking washers shall be installed where mechanical fasteners are used. The pin shall be trimmed back and bent over.
- f. Jacket overlaps shall be secured with staples and tape as necessary to ensure a secure seal. Staples, tape and seams shall be coated with a brush coat of vapor retarder coating or PVDC adhesive tape.
- g. Breaks in the jacket material shall be covered with patches of the same material as the vapor retarder jacket. The patches shall extend not less than 50 mm beyond the break or penetration in all directions and shall be secured with tape and staples. Staples and tape joints shall be sealed with a brush coat of vapor retarder coating or PVDC adhesive tape.
- h. At jacket penetrations such as hangers, thermometers, and damper operating rods, voids in the insulation shall be filled and the penetration sealed with a brush coat of vapor retarder coating or PVDC adhesive tape.
- i. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish or tape with a brush coat of vapor retarder coating.. The coating shall overlap the adjoining insulation and un-insulated surface 50 mm. Pin puncture coatings shall extend 50 mm from the puncture in all directions.
- j. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

3.3.2.2 Installation on Exposed Duct Work

- a. For rectangular ducts, rigid insulation shall be secured to the duct by mechanical fasteners on all four sides of the duct, spaced not more than 300 mm apart and not more than 75 mm from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 300 mm and larger. One row shall be provided for each side of duct less than 300 mm.
- b. Duct insulation shall be formed with minimum jacket seams. Each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projections is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over. Vapor retarder jacket shall be continuous across seams, reinforcing, and projections. When height of projections is greater than the insulation thickness, insulation and jacket shall be carried over.
- c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and the pin trimmed or bent over.
- d. Joints in the insulation jacket shall be sealed with a 100 mm wide strip of tape. Tape seams shall be sealed with a brush coat of vapor retarder coating.
- e. Breaks and ribs or standing seam penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 50 mm beyond the break or penetration and shall be secured with tape and stapled. Staples and joints shall be sealed with a brush coat of vapor retarder coating.
- f. At jacket penetrations such as hangers, thermometers, and damper operating rods, the voids in the insulation shall be filled and the penetrations sealed with a brush coat of vapor retarder coating.
- g. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish. The coating shall overlap the adjoining insulation and un-insulated surface 50 mm. Pin puncture coatings shall extend 50 mm from the puncture in all directions.
- h. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation with minimum density of 12 kg per cubic meter, attached as per MICA standards.

3.3.3 Insulation for Warm Air and Tempered Air Ducts

Insulation and vapor barrier shall be provided for the following warm air /tempered air ducts and associated equipment:.

- a. Supply ducts from ventilation units.
- b. Building exhaust air ducts to ventilation units

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 12 kg per cubic meter; and rigid type where exposed, minimum density 48 kg per cubic meter. Insulation on exposed ducts shall be provided with a white, paint-able, factory-applied Type II jacket, or finished with adhesive finish. Flexible type insulation shall be used for round ducts, minimum density 12 kg per cubic meter with a factory-applied Type II jacket. Insulation on concealed duct shall be provided with a factory-applied Type II jacket. Adhesive finish where indicated to be used shall be accomplished by applying two coats of adhesive with a layer of glass cloth embedded between the coats. The total dry film thickness shall be approximately 2.0 mm. Duct insulation shall be continuous through sleeves and prepared openings. Duct insulation shall terminate at fire dampers and flexible connections.

3.3.3.1 Installation on Concealed Duct

- a. For rectangular, oval and round ducts, insulation shall be attached by applying adhesive around the entire perimeter of the duct in 150 mm wide strips on 300 mm centers.
- b. For rectangular and oval ducts 600 mm and larger, insulation shall be secured to the bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 450 mm centers and not more than 450 mm from duct corner.
- c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 450 mm centers and not more than 450 mm from duct corners.
- d. The insulation shall be impaled on the mechanical fasteners where used. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type hangers.
- e. Self-locking washers shall be installed where mechanical fasteners are used and the pin trimmed and bent over.
- f. Insulation jacket shall overlap not less than 50 mm at joints and the lap shall be secured and stapled on 100 mm centers.

3.3.3.2 Installation on Exposed Duct

- a. For rectangular ducts, the rigid insulation shall be secured to the duct by the use of mechanical fasteners on all four sides of the duct, spaced not more than 400 mm apart and not more than 150 mm from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 300 mm and larger and a minimum of one row for each side of duct less than 300 mm.

- b. Duct insulation with factory-applied jacket shall be formed with minimum jacket seams, and each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projection is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over the projection. Jacket shall be continuous across seams, reinforcing, and projections. Where the height of projections is greater than the insulation thickness, insulation and jacket shall be carried over the projection.
- c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and pin excess clipped and bent over.
- d. Joints on jacketed insulation shall be sealed with a 100 mm wide strip of tape and brushed with vapor retarder coating.
- e. Breaks and penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 50 mm beyond the break or penetration and shall be secured with adhesive and stapled.
- f. Insulation terminations and pin punctures shall be sealed with tape and brushed with vapor retarder coating.
- g. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation, minimum density of 12 kg per cubic meter attached by staples spaced not more than 400 mm and not more than 150 mm from the degrees of joints. Joints shall be sealed in accordance with item "d." above.

3.3.4 Ducts Handling Air for Dual Purpose

For air handling ducts for dual purpose below and above 16 degrees C, ducts shall be insulated as specified for ducts handling cold air.

3.3.5 Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

3.4 EQUIPMENT INSULATION INSTALLATION

3.4.1 General

Removable insulation sections shall be provided to cover parts of equipment that must be opened periodically for maintenance including vessel covers, fasteners, flanges and accessories. Equipment insulation shall be omitted on the following:

- a. Hand-holes.

- b. Manholes.
- c. Cleanouts.
- d. ASME stamps.
- e. Manufacturer's nameplates.

3.4.2 Insulation for Hot Equipment

Insulation shall be furnished on equipment handling media above 16 degrees C including the following:

- a. Heat exchangers.
- d. Water heaters.
- e. Pumps handling media above 54 degrees C.
- g. Hot water storage tanks.
- h. Air separation and expansion tanks.

3.4.2.1 Insulation

Insulation shall be suitable for the temperature encountered.

Insulation thickness for hot equipment shall be determined using Table IV:

Legend

RW: Rockwool

TABLE IV
Insulation Thickness for Hot Equipment (mm)

Equipment handling steam or other media to indicated pressure or temperature limit	Material	Thickness
1379.0kPa or 204 C	RW	75 mm

3.4.2.2 Insulation of Pumps

Insulate pumps by forming a box around the pump housing. The box shall be constructed by forming the bottom and sides using joints that do not leave raw ends of insulation exposed. Bottom and sides shall be banded to form a rigid housing that does not rest on the pump. Joints between top cover and

sides shall fit tightly. The top cover shall have a joint forming a female shiplap joint on the side pieces and a male joint on the top cover, making the top cover removable. Two coats of Class I adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. A parting line shall be provided between the box and the removable sections allowing the removable sections to be removed without disturbing the insulation coating. The total dry thickness of the finish shall be 2.0 mm. Caulking shall be applied to parting line of the removable sections and penetrations.

3.4.2.3 Other Equipment

- a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.
- b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not greater than 300 mm centers. Insulation corners shall be protected under wires and bands with suitable corner angles.
- c. On high vibration equipment, joints shall be filled with finishing cement.
- d. Insulation on heads of heat exchangers shall be removable. The removable section joint shall be fabricated using a male-female shiplap type joint. Entire surface of the removable section shall be finished as specified.
- e. Exposed insulation corners shall be protected with corner angles.
- h. Upon completion of installation of insulation, penetrations shall be caulked. Two coats of adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 2.0 mm. Caulking shall be applied to parting line between equipment and removable section insulation.

3.4.3 Equipment Handling Dual Temperature Media

Below and above 16 degrees C: equipment handling dual temperature media shall be insulated as specified for cold equipment.

-- End of Section --

SECTION 15400A

PLUMBING, GENERAL PURPOSE
04/04

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z124.5 (1997) Plastic Toilet (Water Closet) Seats

ANSI Z21.22 (1999; A 2001) Relief Valves for Hot Water Supply Systems

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 (2001; various Errata) Energy Standard for Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1002 (1999) Anti-siphon Fill Valves (Ballcocks) for Gravity Water Closet Flush Tanks

ASSE 1005 (1999) Water Heater Drain Valves

ASSE 1010 (1996) Water Hammer Arresters

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300 (1999) Hypochlorites

AWWA B301 (1999) Liquid Chlorine

AWWA C203 (2002; A C203a-99) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

AWWA C606 (1997) Grooved and Shouldered Joints

AWWA C651 (1999) Disinfecting Water Mains

AWWA C652 (2002) Disinfection of Water-Storage Facilities

AWWA D100 (1996) Welded Steel Tanks for Water Storage

AWWA EWW (1998) Standard Methods for the
Examination of Water and Wastewater

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8 (1992) Filler Metals for Brazing and Braze
Welding

AWS B2.2 (1991) Brazing Procedure and Performance
Qualification

ASME INTERNATIONAL (ASME)

ASME A112.18.1 (2003) Plumbing Fixture Fittings

ASME A112.19.1M (1994; R 1999) Enameled Cast Iron Plumbing
Fixtures

ASME A112.19.2M (1998) Vitreous China Plumbing Fixtures

ASME A112.19.3 (2001) Stainless Steel Fixtures (Designed
for Residential Use)

ASME A112.36.2M (1991; R 2002) Cleanouts

ASME A112.6.3 (2001) Floor and French Drains

ASME B1.20.1 (1983; R 2001) Pipe Threads, General
Purpose, Inch

ASME B16.12 (1998) Cast Iron Threaded Drainage Fittings

ASME B16.15 (1985; R 1994) Cast Bronze Threaded
Fittings Classes 125 and 250

ASME B16.18 (2002) Cast Copper Alloy Solder Joint
Pressure Fittings

ASME B16.21 (1992) Nonmetallic Flat Gaskets for Pipe
Flanges

ASME B16.22 (2002) Wrought Copper and Copper Alloy
Solder Joint Pressure Fittings

ASME B16.23 (2002) Cast Copper Alloy Solder Joint
Drainage Fittings - DWV

ASME B16.24 (2002) Cast Copper Alloy Pipe Flanges and
Flanged Fittings: Classes 150, 300, 400,
600, 900, 1500, and 2500

ASME B16.29	(2002) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings
ASME B31.5	(2001) Refrigeration Piping and Heat Transfer Components
ASME B40.100	(2000) Pressure Gauges and Gauge Attachments
ASME BPVC SEC VIII D1	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME CSD-1	(2002) Control and Safety Devices for Automatically Fired Boilers

ASTM INTERNATIONAL (ASTM)

ASTM A 105/A 105M	(2002) Carbon Steel Forgings for Piping Applications
ASTM A 183	(2003) Carbon Steel Track Bolts and Nuts
ASTM A 193/A 193M	(2003) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 515/A 515M	(2003) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A 516/A 516M	(2003) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 733	(2003) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A 74	(2003b) Cast Iron Soil Pipe and Fittings

ASTM A 888	(2003) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B 111M	(1998e1) Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock (Metric)
ASTM B 117	(2002) Operating Salt Spray (Fog) Apparatus
ASTM B 152/B 152M	(2000) Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B 306	(2002) Copper Drainage Tube (DWV)
ASTM B 32	(2003) Solder Metal
ASTM B 42	(2002) Seamless Copper Pipe, Standard Sizes
ASTM B 43	(1998) Seamless Red Brass Pipe, Standard Sizes
ASTM B 584	(2000) Copper Alloy Sand Castings for General Applications
ASTM B 75M	(1999) Seamless Copper Tube (Metric)
ASTM B 813	(2000e1) Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM B 828	(2002) Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM B 88	(2002) Seamless Copper Water Tube
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM C 564	(2003) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 1785	(1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2000	(2001) Rubber Products in Automotive Applications
ASTM D 2241	(2000) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D 2466	(2002) Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2002) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2485	(1991; R 2000) Evaluating Coatings for High Temperature Service
ASTM D 2672	(1996a) Joints for IPS PVC Pipe Using Solvent Cement
ASTM D 2996	(2001) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(1996a; R 2003) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3308	(2001) PTFE Resin Skived Tape
ASTM D 3311	(2002) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM D 4060	(2001) Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM E 1	(2003) ASTM Thermometers
ASTM F 409	(2002) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
ASTM F 438	(2002e1) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F 439	(2002e1) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 477	(2002e1) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 877	(2002a) Crosslinked Polyethylene (PEX) Plastic Hot- and Cold- Water Distribution Systems

CAST IRON SOIL PIPE INSTITUTE (CISPI)

- CISPI 301 (2000) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
- CISPI 310 (1997) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

COPPER DEVELOPMENT ASSOCIATION (CDA)

- CDA A4015 (1994; R 1995) Copper Tube Handbook

INTERNATIONAL CODE COUNCIL (ICC)

- ICC A117.1 (1998) Accessible and Usable Buildings and Facilities
- ICC IPC (2003) International Plumbing Code

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

- MSS SP-110 (1996) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
- MSS SP-25 (1998) Standard Marking System for Valves, Fittings, Flanges and Unions
- MSS SP-44 (1996; R 2001) Steel Pipeline Flanges
- MSS SP-58 (2002) Pipe Hangers and Supports - Materials, Design and Manufacture
- MSS SP-67 (2002) Butterfly Valves
- MSS SP-69 (2002) Pipe Hangers and Supports - Selection and Application
- MSS SP-70 (1998) Cast Iron Gate Valves, Flanged and Threaded Ends
- MSS SP-71 (1997) Gray Iron Swing Check Valves, Flanged and Threaded Ends
- MSS SP-72 (1999) Ball Valves with Flanged or Butt-Welding Ends for General Service
- MSS SP-73 (2003) Brazing Joints for Copper and Copper Alloy Pressure Fittings

MSS SP-80 (2003) Bronze Gate, Globe, Angle and Check Valves

MSS SP-83 (2001) Class 3000 Steel Pipe Unions, Socket-Welding and Threaded

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (2002) Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF 14 (2003) Plastics Piping System Components and Related Materials

NSF 61 (2002e) Drinking Water System Components - Health Effects

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA-01 (1998) Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201 (1992) Water Hammer Arresters

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1508 (1997) Hose Clamp Specifications

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 5 (2000) White Metal Blast Cleaning

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

21 CFR 175 Indirect Food Additives: Adhesives and Components of Coatings

40 CFR 50.12 National Primary and Secondary Ambient Air Quality Standards for Lead

PL 93-523 (1974; A 1999) Safe Drinking Water Act

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL

PROCEDURES:

SD-02 Shop Drawings

Plumbing System; G

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operations of each system. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale. Provide the manufacturer's written installation instructions and recommendations for all fixtures and equipment to be installed.

SD-03 Product Data

Plumbing Fixture Schedule

Catalog cuts of specified plumbing fixtures, valves, related piping system and system location where installed.

Plumbing System

Diagrams, instructions, and other sheets proposed for posting. Manufacturer's recommendations for the installation of bell and spigot and hubless joints for cast iron soil pipe.

SD-06 Test Reports

Tests, Flushing and Disinfection

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Test of Backflow Prevention Assemblies; G.

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests. If no state requirement exists, the Contractor shall have the manufacturer's representative test the device, to ensure the unit is properly installed and performing as intended. The Contractor shall provide written documentation of the tests performed and signed by the individual performing the tests.

SD-07 Certificates

Materials and Equipment

Where materials or equipment are specified to comply with requirements of AGA, ASME, or NSF proof of such compliance shall be included. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

Bolts

Written certification by the bolt manufacturer that the bolts furnished comply with the specified requirements. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

SD-10 Operation and Maintenance Data

Plumbing System; G.

Six copies of the operation manual outlining the step-by-step procedures required for system startup, operation and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of the maintenance manual listing routine maintenance procedures, possible breakdowns and repairs. The manual shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

1.3 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening.

1.4 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with ICC IPC.

1.5 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify

dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

PART 2 PRODUCTS

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II.

Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, and fittings meet NSF 14 and shall be NSF listed for the service intended. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing lead shall not be used in any potable water system. In line devices such as building valves, check valves, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF 61, Section 8. End point devices such as drinking water fountains, lavatory faucets, kitchen supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF 61, Section 9. Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

2.1.1 Pipe Joint Materials

Grooved pipe and hubless cast-iron soil pipe shall not be used under ground. Joints and gasket materials shall conform to the following:

- a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A 74, AWWA C606. For hubless type: CISPI 310
- b. Coupling for Steel Pipe: AWWA C606.
- c. Couplings for Grooved Pipe: Ductile Iron ASTM A 536 (Grade 65-45-12) and Malleable Iron ASTM A 47/A 47M, Grade 32510. Copper ASTM A 536.
- d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1.6 mm (1/16 inch) thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.
- f. Brazing Material: Brazing material shall conform to AWS A5.8, BCuP-5.
- g. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.

- h. Solder Material: Solder metal shall conform to ASTM B 32.
- i. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B 813, Standard Test 1.
- j. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe, ASTM D 3308.
- k. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C 564.
- l. Rubber Gaskets for Grooved Pipe: ASTM D 2000, maximum temperature 110 degrees C (230 degrees F).
- m. Flexible Elastomeric Seals: ASTM D 3139, ASTM D 3212 or ASTM F 477.
- n. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A 183.
- o. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105/A 105M. Blind flange material shall conform to ASTM A 516/A 516M cold service and ASTM A 515/A 515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193/A 193M.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

- a. Water Hammer Arrestor: PDI WH 201.
- b. Hose Clamps: SAE J1508.
- c. Metallic Cleanouts: ASME A112.36.2M.
- d. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.
- e. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.
- f. Hypochlorites: AWWA B300.
- g. Liquid Chlorine: AWWA B301.
- h. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.
- i. Thermometers: ASTM E 1. Mercury shall not be used in

thermometers.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 65 mm (2-1/2 inches) and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 80 mm (3 inches) and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Vacuum Relief Valves	ANSI Z21.22
Water Heater Drain Valves	ASSE 1005
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

2.3.1 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22. Relief valves for systems where the maximum rate of heat input is less than 59 kW (200,000 Btuh) shall have 20 mm (3/4 inch) minimum inlets, and 20 mm (3/4 inch) outlets. Relief valves for systems where the maximum rate of heat input is greater than 59 kW (200,000 Btuh) shall have 25 mm (1 inch) minimum inlets, and 25 mm (1 inch) outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

2.3.2 Thermostatic Mixing Valves

Mixing valves, thermostatic type, pressure-balanced or combination thermostatic and pressure-balanced shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast bronze, and interior parts shall be brass, bronze, corrosion-resisting steel or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 2 degrees C of any setting.

2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with ICC IPC. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 82 degrees C (180 degrees F) water temperature. Plumbing fixtures shall be as indicated in paragraph

PLUMBING FIXTURE SCHEDULE.

2.4.1 Lavatories

Vitreous china lavatories shall be provided with two integral molded lugs on the back-underside of the fixture and drilled for bolting to the wall in a manner similar to the hanger plate.

2.5 DRAINS

2.5.1 Floor Drains (FD-1)

Floor drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated, nickel-bronze, strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded connection. Between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C 564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor drains shall conform to ASME A112.6.3.

2.5.2 Boiler Room Drains (FD-2)

Boiler room drains shall have combined drain and trap, hinged grate, removable bucket, and threaded brass cleanout with brass backwater valve. The removable galvanized cast-iron sediment bucket shall have rounded corners to eliminate fouling and shall be equipped with hand grips. Drain shall have a minimum water seal of 100 mm (4 inches). The grate area shall be not less than 0.065 square meters (100 square inches).

2.6 TRAPS

Unless otherwise specified, traps shall be plastic per ASTM F 409 or copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.813 mm (0.032 inch) thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 50 mm (2 inches). The interior diameter shall be not more than 3.2 mm (1/8 inch) over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly

shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.7 WATER HEATERS

Water heater types and capacities shall be as indicated. Each water heater shall have replaceable anodes. Each primary water heater shall have controls with an adjustable range that includes 32 to 71 degrees C (90 to 160 degrees F). Each steam-fired water heater shall have controls with an adjustable range that includes 49 to 82 degrees C (120 to 180 degrees F). Hot water systems utilizing recirculation systems shall be tied into building off-hour controls. The thermal efficiencies and standby heat losses shall conform to TABLE III for each type of water heater specified. The only exception is that storage water heaters and hot water storage tanks having more than 2000 liters storage capacity need not meet the standard loss requirement if the tank surface area is insulated to R-12.5 and if a standing light is not used. Plastic materials polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases. A factory pre-charged expansion tank shall be installed on the cold water supply to each water heater. Expansion tanks shall be specifically designed for use on potable water systems and shall be rated for 93 degrees C water temperature and 1034 kPa working pressure. The expansion tank size and acceptance volume shall be as indicated.

2.7.1 Automatic Storage Type

Heaters shall be complete with control system, temperature gauge, and pressure gauge, and shall have ASME rated combination pressure and temperature relief valve.

2.7.1.1 Indirect Heater Type

Steam and high temperature hot water (HTHW) heaters with storage system shall be the assembled product of one manufacturer, and be ASME tested and "U" stamped to code requirements under ASME BPVC SEC VIII D1. The storage tank shall be as specified in paragraph HOT-WATER STORAGE TANKS. The heat exchanger shall be double wall type that separates the potable water from the heat transfer medium with a space vented to the atmosphere in accordance with ICC IPC. The coil shall be coated as specified in paragraph Water Heater, Phenolic Resin Coatings.

- a. HTHW Energy Source: The heater element shall have a working pressure of 2758 kPa with water at a temperature of 204 degrees C. The heating surface shall be based on 0.093 square meter of heating surface to heat 76 L or more of water in 1 hour from 4 to 82 degrees C using hot water at a temperature of 178 degrees C. Carbon steel heads shall be used. Tubing shall conform to ASTM B 111M, Copper Alloy No. 706 (90-10 copper-nickel). Heating elements shall withstand an internal hydrostatic pressure of 4137 kPa for not less than 15 seconds without leaking or any evidence of damage.
- b. Steam Energy Source: The heater element shall have a working

pressure of 1034 kPa per square meter gauge (psig) with steam at a temperature of 185 degrees C. The heating surface shall be based on 0.093 square meter of heating surface to heat 76 L or more of water in 1 hour from 4 to 82 degrees C using steam at atmospheric pressure. Cast iron heads shall be used. Tubing shall be light-drawn copper tubing conforming to ASTM B 75M. Heating elements shall withstand an internal hydrostatic pressure of 1551 kPa for not less than 15 seconds without leaking or any evidence of damage.

2.7.2 Instantaneous Water Heater

Heater shall be crossflow design with service water in the coil and steam in the shell. An integral internal controller shall be provided, anticipating a change in demand so that the final temperature can be maintained under all normal load conditions when used in conjunction with pilot-operated temperature control system. Normal load conditions shall be as specified by the manufacturer for the heater. Unit shall be manufactured in accordance with ASME BPVC SEC VIII D1, and shall be certified for 1.03 MPa (150 psi) working pressure in the shell and 1.03 MPa (150 psi) working pressure in the coils. Shell shall be carbon steel with copper lining. Heads shall be carbon steel plate with copper lining. Coils shall be copper. Shell shall have metal sheathed fiberglass insulation, combination pressure and temperature relief valve, and thermometer. Insulation shall be as specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.7.3 Phenolic Resin Coatings

The phenolic resin coating shall be applied at either the coil or coating manufacturer's factory. The coil shall be chemically cleaned to remove any scale if present and to etch the metal surface. The exposed exterior surface of the coil shall be abrasively cleaned to white metal blast in accordance with SSPC SP 5. The coating shall be a product specifically intended for use on the material the water heating coils are made of and shall be acceptable for use in potable water systems. Steel, copper, copper alloy, or stainless steel coatings shall be capable of withstanding temperatures up to 204 degrees C (400 degrees F) dry bulb; and meet the requirements of 21 CFR 175. The entire exterior surface and the first 125 mm (5 inches) to 200 mm (8 inches) inside the tubes of each coil shall be coated with three component phenolic resin coating system. The system shall consist of the following: wash primer, pigmented base coat, and the clear top coat. Immediate and final cure times and temperatures shall be as recommended by the coating manufacturer.

2.7.3.1 Wash Primer

The wash primer shall be composed of a combination of polyvinyl butyral and a heat hardening phenolic resin. The weight per liter (gallon) shall be between 0.8388 kg per liter (7.0 lbs. per gallon) minimum and 0.8867 kg per liter (7.4 lbs. per gallon) maximum.

2.7.3.2 Pigmented Base Coat

The pigmented baking phenolic base coat shall consist of heat hardening phenolic resins, suitable pigments of the earth type, and softening agents, and shall not contain drying oils or cellulose material. The weight per liter (gallon) shall be between 1.2 kg per liter (10.3 lbs per gallon) minimum and 1.3 kg per liter (10.7 lbs per gallon) maximum. The non-volatile solids content shall be between 60 percent minimum and 64 percent maximum by weight.

2.7.3.3 Clear Top Coat

The clear non-pigmented baking phenolic top coat shall have a weight per liter (gallon) of between 1.0 kg per liter (8.65 lbs per gallon) minimum and 1.1 kg per liter (8.95 lbs per gallon) maximum. The non-volatile solids content shall be between 48 percent minimum and 52 percent maximum by weight.

2.7.3.4 Certificate of Compliance

A certificate of compliance shall be submitted by the coating manufacturer that documents successful use of coating system under service conditions indicated on the drawings for a minimum of 2 years at three different locations, and that the coating material and application comply with the testing procedures outlined.

2.7.3.5 Test Panels

Steel test panel substrate shall be 0.607 mm (24 gauge) in thickness. The panels shall be coated with one coat wash primer, then pigmented baking phenolic to a dry film thickness of 0.10 to 0.15 mm, then clear baking phenolic to a total dry film thickness of 0.13 to 0.18 mm. The panels shall then be subjected to the tests specified below:

- a. Heat Test: Test panel shall be minimum 70 x 150 mm in size. A coated test panel shall show no cracking, flaking, or other failure after the panel has been tested in accordance with ASTM D 2485, with a furnace temperature of 204 degrees C (400 degrees F).
- b. Abrasion Test: A coated test panel shall show no more than a 40 milligram loss when tested in accordance with ASTM D 4060, utilizing a Tabor Abraser CS-17F wheel with a 1000 g weight for 1000 cycles.
- c. Corrosion Test: A coated test panel shall show no corrosion after being subjected to a 500 hour salt spray test in accordance with ASTM B 117.

2.8 HOT-WATER STORAGE TANKS

Hot-water storage tanks shall be constructed by one manufacturer, ASME stamped for the working pressure, and shall have the National Board (ASME) registration. The tank shall be cement-lined or glass-lined steel type in accordance with AWWA D100. The heat loss shall conform to TABLE III as

determined by the requirements of ASHRAE 90.1. Each tank shall be equipped with a thermometer, conforming to ASTM E 1, Type I, Class 3, Range C, style and form as required for the installation, and with 175 mm (7 inch) scale.

Thermometer shall have a separable socket suitable for a 20 mm (3/4 inch) tapped opening. Tanks shall be equipped with a pressure gauge 155 mm (6 inch) minimum diameter face. Insulation shall be as specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS. Storage tank capacity shall be as shown.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Plastic pipe shall not be installed in air plenums or fire rated walls. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA-01. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 1.5 m outside the building, unless otherwise indicated. A gate valve and drain shall be installed on the water service line inside the building approximately 1 m above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Exterior utilities shall be as indicated on the civil drawings.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, shower heads, and flushing devices shall be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted,

and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 12 mm between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 100 mm (4 inches) and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Pipe Drains

Pipe drains indicated shall consist of 20 mm (3/4 inch) hose bibb with renewable seat and ball valve ahead of hose bibb. At other low points, 20 mm (3/4 inch) brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.1.1.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 15 m in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

3.1.1.7 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with precise location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to ASSE 1010. Vertical capped pipe columns will not be permitted.

3.1.2 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.1.2.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.2.2 Mechanical Couplings

Grooved mechanical joints shall be prepared according to the coupling manufacturer's instructions. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, or narrow-land micrometer. Groove width and dimension of groove from end of the pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.1.2.3 Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 65 mm (2-1/2 inches) and smaller; flanges shall be used on pipe sizes 80 mm (3 inches) and larger.

3.1.2.4 Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall

be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

3.1.2.5 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

3.1.2.6 Copper Tube and Pipe

- a. Brazed. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.
- b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 50 mm (2 inches) and smaller. Soldered joints shall conform to ASME B31.5 and CDA A4015. Soldered joints shall not be used in compressed air piping between the air compressor and the receiver.
- c. Copper Tube Extracted Joint. Mechanically extracted joints shall be made in accordance with ICC IPC.

3.1.2.7 Other Joint Methods

PEX piping shall be jointed together with fittings per manufacturers recommendations.

3.1.3 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.4 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.4.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for supply, drainage, waste and vent pipe passing through concrete slab, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 100 mm above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 6 mm (1/4 inch) clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C 920 and with a primer, backstop material and surface preparation as specified in Section 07920 JOINT SEALANTS. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below-grade walls in contact with earth shall be recessed 12 mm (1/2 inch) from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and masonry wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in Section 07840 FIRESTOPPING.

3.1.4.2 Flashing Requirements

Pipes passing through roof shall be installed as detailed on drawings.

3.1.4.3 Pipe Penetrations of Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate grade floors, a groove 6 to 13 mm wide by 6 to 10 mm deep shall

be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07920 JOINT SEALANTS.

3.1.5 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07840 FIRESTOPPING.

3.1.6 Supports

3.1.6.1 General

Hangers used to support piping 50 mm (2 inches) and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

3.1.6.2 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

- a. Types 5, 12, and 26 shall not be used.
- b. Type 3 shall not be used on insulated pipe.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.
- d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
- e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.
- f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.
- g. Type 39 saddles shall be used on insulated pipe 100 mm (4 inches) and larger when the temperature of the medium is 15 degrees C or higher. Type 39 saddles shall be welded to the pipe.

h. Type 40 shields shall:

- (1) Be used on insulated pipe less than 100 mm (4 inches).
- (2) Be used on insulated pipe 100 mm (4 inches) and larger when the temperature of the medium is 15 degrees C or less.
- (3) Have a high density insert for all pipe sizes. High density inserts shall have a density of 128 kg per cubic meter (8 pcf) or greater.

i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 300 mm from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 m apart at valves.

j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 4.5 m nor more than 2 m from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.

k. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.

l. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 100 mm or by an amount adequate for the insulation, whichever is greater.

3.1.6.3 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

3.1.7 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 100 mm (4 inches) will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 100 mm

(4 inches). Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, and on each building drain outside the building. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be plastic.

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 150 mm above the top of the tank or water heater.

3.2.2 Phenolic Resin Application Process

The phenolic resin coating shall be applied at either the coil or coating manufacturer's factory. The steam coil shall be chemically cleaned to remove any scale if present and to etch the metal surface. The exposed exterior surface of the coil shall be abrasively cleaned to white metal blast in accordance with SSPC SP 5. The exterior surface shall be coated with the three-component coating system in the following sequence and manner. For immediate and final cure times and temperature, the recommendations of the coating manufacturer shall be followed.

- a. Wash Primer. One coat of wash primer shall be applied by flooding.
- b. Pigmented Base Coat. Pigmented baking phenolic coating shall be applied in several coats by immersion or flooding to a dry film thickness of 0.10 to 0.15 mm.
- c. Clear Top Coat. Clear non-pigmented baking phenolic top coat shall be applied in several coats by immersion or flooding. The final coat may be applied by spraying. The dry film thickness of the total coating system shall be between 0.13 and 0.18 mm.

3.2.3 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.2.4 Expansion Tank

A pre-charged expansion tank shall be installed on the cold water supply between the water heater inlet and the cold water supply shut-off valve. The Contractor shall adjust the expansion tank air pressure, as recommended by the tank manufacturer, to match incoming water pressure.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 775 mm above finished floor. Installation of fixtures for use by the physically handicapped shall be in accordance with ICC A117.1.

3.3.3 Shower Bath Outfits

The area around the water supply piping to the mixing valves and behind the escutcheon plate shall be made watertight by caulking or gasketing.

3.3.4 Fixture Supports

Fixture supports for off-the-floor lavatories, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is

not possible to anchor a floor-mounted chair carrier to the floor slab.

3.3.4.1 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright.

3.3.5 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with ICC IPC at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

3.3.6 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified in Section 05500A MISCELLANEOUS METAL.

3.3.7 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 50 mm above the flood rim of the funnel to provide an acceptable air gap.

3.3.8 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D 3311.

3.4 IDENTIFICATION SYSTEMS

3.4.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures.

Tags shall be 35 mm (1-3/8 inch) minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

3.4.2 Pipe Color Code Marking

Color code marking of piping shall be as specified in Section 09900 PAINTS AND COATINGS.

3.4.3 Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 12 mm in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 1 m width, 750 mm height, and 12 mm thickness.

The board shall be made of wood fiberboard and framed under glass or 1.6 mm (1/16 inch) transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 20 mm (3/4 inch) in diameter and the related lettering in 12 mm high capital letters. The color code board shall be mounted and located in the mechanical or equipment room.

3.5 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.6 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09900 PAINTS AND COATINGS.

3.7 TESTS, FLUSHING AND DISINFECTION

3.7.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance

with ICC IPC, except that the drainage and vent system final test shall include the smoke test. The Contractor has the option to perform a peppermint test in lieu of the smoke test. If a peppermint test is chosen, the Contractor must submit a testing procedure to the Contracting Officer for approval.

- a. Drainage and Vent Systems Test. The final test shall include a smoke test.
- b. Building Sewers Tests.
- c. Water Supply Systems Tests.

3.7.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies. Gauges shall be tested annually for accuracy in accordance with the University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14). Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address
Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test
Location	
Test Pressure Readings	Serial Number and Test Data of
Gauges	

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.7.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

3.7.3 System Flushing

3.7.3.1 During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 1.2 meters per second (4 fps) through all portions of the piping system. In the event that this is impossible due to size of system,

the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. All faucets to include any device considered as an end point device by NSF 61, Section 9, shall be flushed a minimum of 1 L per 24 hour period, ten times over a 14 day period.

3.7.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation. Unless more stringent local requirements exist, lead levels shall not exceed limits established by 40 CFR 50.12 Part 141.80(c)(1). The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

3.7.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

- a. Time, date, and duration of test.
- b. Water pressures at the most remote and the highest fixtures.
- c. Operation of each fixture and fixture trim.
- d. Operation of each valve, hydrant, and faucet.
- e. Temperature of each domestic hot-water supply.
- f. Operation of each floor drain by flooding with water.
- g. Operation of each vacuum breaker and backflow preventer.

3.7.5 Disinfection

After operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. System shall be

flushed as specified, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Except as herein specified, water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to ensure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being disinfected shall be opened and closed several times during the contact period to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. Water tanks shall be disinfected by the addition of chlorine directly to the filling water. Following a 6 hour period, no less than 50 ppm chlorine residual shall remain in the tank. If after the 24 hour and 6 hour holding periods, the residual solution contains less than 25 ppm and 50 ppm chlorine respectively, flush the piping and tank with potable water, and repeat the above procedures until the required residual chlorine levels are satisfied.

The system including the tanks shall then be flushed with clean water until the residual chlorine level is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. Samples of water in disinfected containers shall be obtained from several locations selected by the Contracting Officer. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. Disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.8 PLUMBING FIXTURE SCHEDULE

WC-1 WATER CLOSET:

Siphon-jet, elongated bowl, ASME A112.19.2M, floor mounted . Floor flange shall be copper alloy, or cast iron.

Gasket shall be wax type.

Seat - ANSI Z124.5, white plastic, elongated, open front with lid.

Flush Tank - An adequate quantity of water shall be provided to flush and clean the fixture served. The water supply to flush tanks equipped for manual flushing shall be controlled by a float valve or other automatic device designed to refill the tank after each discharge, and to completely shut off the water flow to the tank when the tank is filled to operational capacity. Water closets having their flush valve seat located below the flood level rim of the closet bowl shall have a ballcock installed within a sheath or in a separate and isolated compartment of the tank, both to have

visible discharge onto the floor in case of failure. Provision shall be made to automatically supply water to the fixture so as to refill the trap seal after each flushing. The water supply to flush tanks equipped for automatic flushing shall be controlled by a suitable timing device. Ballcocks shall meet ASSE 1002.

WC-2 WATER CLOSET HANDICAPPED:

Height of top rim of bowl shall be in accordance with ICC A117.1; other features are the same as WC-1.

BT-1 BATHTUB/SHOWER:

Recessed bathtub, 1.524 m in length, manufacturer's standard width and depth, enameled cast iron, ASME A112.19.1M.

Drain Assembly - Plug, cup strainer, overflow assembly, washers, couplings, pop-up lever, trip lever, stopper, fittings, etc., shall be brass, cast copper alloy, or wrought copper alloy. See paragraph FIXTURES for optional plastic accessories.

Shower heads, ASME A112.18.1 other than emergency showers, shall be adjustable spray type and shall include a non-removable, tamperproof device to limit water flow to 0.16 liters per second (2.5 gpm) when tested in accordance with ASME A112.18.1.

Shower head shall be on a 5'-0 chrome plate hose, mounted on an adjustable slide bar. Handles shall be chrome-plated die cast zinc alloy. Control valves shall be copper alloy and have metal integral parts of copper alloy. Valves shall be thermostatic, pressure balancing, single lever type with integral stops diverter and high temperature limit setting. Damixa 75824 or approved equal.

Bath showers shall include bathtub spout, shower head, valves, and diverters. Tub spout shall be copper alloy. Damixa 15106 or approved equal.

L-1 LAVATORY:

Lavatory countertop with integral bowl by General Contractor.

Faucet - Faucets shall meet the requirements of NSF 61, Section 9. Faucets shall be center set, single control, mixing type. Faucets shall have replaceable seats and washers. Valves and handle shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. If a metering device is not used, the flow shall be limited to 0.16 liters per second at a flowing pressure of 549 kPa. Damixa, 15826 or approved equal.

Handles - Lever type. Cast, formed, or drop forged copper alloy.

Drain - Pop-up drain shall include stopper, lift rods, jam nut, washer, and tail piece. See paragraph FIXTURES for optional plastic accessories.

L-2 LAVATORY (Handicap):

Manufacturer's standard sink depth vitreous china ASME A112.19.2M, ledge back, rectangular wallmount.

Faucet - Faucets shall meet the requirements of NSF 61, Section 9. Faucets shall be center set, single control, mixing type. Faucets shall have replaceable seats and washers. Valves and handle shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. If a metering device is not used, the flow shall be limited to 0.16 liters per second at a flowing pressure of 549 kPa. Damixa, 15826 or approved equal.

Handles - Lever type. Cast, formed, or drop forged copper alloy.

Drain - Pop-up drain shall include stopper, lift rods, jam nut, washer, tail piece, insulated supplies, and trap. See paragraph FIXTURES for optional plastic accessories.

KS-1 KITCHEN SINK:

Ledge back with holes for faucet and spout single bowl 635 x 533.4 mm (25 x 21 inches), bowl size 533.4 x 400 mm (21 x 15-3/4 inches) stainless steel ASME A112.19.3.

Faucet and Spout - Faucets shall meet the requirements of NSF 61, Section 9. Cast or wrought copper alloy. Aerator shall have internal threads. Flow shall be limited to 1 liter per cycle at a flowing water pressure of 549 kPa if a metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 0.16 liters per second at a flowing water pressure of 549 kPa. Damixa, 15006 or approved equal.

Handle - Cast copper alloy, wrought copper alloy, or stainless steel. Single lever type.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc., shall be copper alloy or stainless steel.

KS-2 KITCHEN SINK:

Ledge back with holes for faucet and spout double bowl 812.8 x 558.8 mm (32 x 22 inches), bowl sizes 342.9 x 406.4 mm (13-1/2 x 16 inches) stainless steel ASME A112.19.3.

Faucet and Spout - Faucets shall meet the requirements of NSF 61, Section 9. Cast or wrought copper alloy. Aerator shall have internal threads. Flow shall be limited to 1 liter per cycle at a flowing water pressure of 549 kPa if a metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 0.16 liters per second at a flowing water pressure of 549 kPa. Damixa, 15006 or approved equal.

Handle - Cast copper alloy, wrought copper alloy, or stainless steel.
Single lever type.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc., shall be copper alloy or stainless steel.

WM-1 Washing Machine Connector Box:

Provide recessed wall box fabricated of aluminum. Provide drain nipple and locknut with cover nut for locking drain outlet to box. Provide brass pipe fittings for connecting each supply pipe to valve and locking to box. Provide hot water and cold water supply valves similar to hose bibbs, except valve inlet connections shall be of the union type.

MOP RECEPTOR MR-1:

Enameled cast iron ASME A112.19.1M, copper alloy corner, floor mounted 711.2 mm (28 inches) square, 171.5 mm (6-3/4 inches) deep with rim guard, hose and bracket and mop rack.

Faucet and Spout - Cast or wrought copper alloy, with top or bottom brace, with backflow preventer. Faucets shall have replaceable seat and the washer shall rotate onto the seat. Handles shall be lever type. Strainers shall have internal threads.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc., shall be copper alloy or stainless steel.

Trap - Cast iron, minimum 7.5 cm diameter.

3.9 PERFORMANCE OF WATER HEATING EQUIPMENT

Standard rating condition terms are as follows:

EF = Energy factor, overall efficiency.

ET = Thermal efficiency with 21 degrees C delta T.

EC = Combustion efficiency, 100 percent - flue loss when smoke = 0 (trace is permitted).

SL = Standby loss in W/0.093 sq. m. based on 27 degrees C delta T, or in percent per hour based on nominal 38 degrees C delta T.

HL = Heat loss of tank surface area.

V = Storage volume in liters

3.9.1 Unfired Hot Water Storage

Volumes and inputs: maximum HL shall be 20.5 W/sq. meter.

3.10 TABLES

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

		SERVICE			
Item #	Pipe and Fitting Materials	A	B	D	F
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A 74 with compression gaskets. Pipe and fittings shall be marked with the CISPI trademark.		X	X	
2	Cast iron soil pipe and fittings hubless, CISPI 301 and ASTM A 888. Pipe and fittings shall be marked with the CISPI trademark.		X	X	
3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10			X	
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10				X
5	Grooved pipe couplings, ferrous and non-ferrous pipe ASTM A 536 and ASTM A 47/A 47M		X		X
6	Ductile iron grooved joint fittings for ferrous pipe ASTM A 536 and ASTM A 47/A 47M for use with Item 5		X		X
7	Bronze sand casting grooved joint pressure fittings for non-ferrous pipe ASTM B 584, for use with Item 5		X		X
8	Wrought copper grooved joint pressure fittings for non-ferrous pipe ASTM B 75M C12200, ASTM B 152/B 152M, C11000, ASME B16.22 ASME B16.22 for use with Item 5		X		
9	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 10				X

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

		SERVICE			
Item #	Pipe and Fitting Materials	A	B	D	F
10	Steel pipe, seamless galvanized, ASTM A 53/A 53M, Type S, Grade B				X
11	Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14				X
12	Cast copper alloy solder joint pressure fittings, ASME B16.18 for use with Item 14				X
13	Seamless copper pipe, ASTM B 42				X
14	Cast bronze threaded fittings, ASME B16.15				X
15	Copper drainage tube, (DWV), ASTM B 306	X*	X	X	
16	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	
17	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	

SERVICE:

- A - Underground Building Soil, Waste and Storm Drain
- B - Aboveground Soil, Waste, Drain In Buildings
- C - Underground Vent
- D - Aboveground Vent
- E - Interior Rainwater Conductors Aboveground
- F - Corrosive Waste And Vent Above And Belowground
- * - Hard Temper

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item No.	Pipe and Fitting Materials	SERVICE		
		A	B	
1	Malleable-iron threaded fittings, a. Galvanized, ASME B16.3 for use with Item 4a		X	X X
2	Grooved pipe couplings, ferrous pipe ASTM A 536 and ASTM A 47/A 47M, non-ferrous pipe, ASTM A 536 and ASTM A 47/A 47M,		X	
3	Ductile iron grooved joint fittings for ferrous pipe ASTM A 536 and ASTM A 47/A 47M, for use with Item 2		X	
4	Steel pipe: a. Seamless, galvanized, ASTM A 53/A 53M, Type S, Grade B		X	
5	Seamless red brass pipe, ASTM B 43		X	
6	Bronze flanged fittings, ASME B16.24 for use with Items 5 and 7		X	
7	Seamless copper pipe, ASTM B 42		X	
8	Seamless copper water tube, ASTM B 88, ASTM B 88M		X**	
9	Cast bronze threaded fittings, ASME B16.15 for use with Items 5 and 7		X	
10	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5, 7 and 8		X	
11	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Item 8		X	

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item No.	Pipe and Fitting Materials	SERVICE	
		A	B
12	Bronze and sand castings grooved joint pressure fittings for non-ferrous pipe ASTM B 584, for use with Item 2		X
13	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 40, ASTM F 438 for use with Items 20, 21, and 22	X	X
14	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings Schedule 80, ASTM F 439 for use with Items 20, 21, and 22	X	X
15	Polyvinyl chloride (PVC) plastic pipe, Schedules 40, 80, and 120, ASTM D 1785	X	
16	Polyvinyl chloride (PVC) pressure-rated pipe (SDR Series), ASTM D 2241	X	
17	Polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40, ASTM D 2466	X	
18	Socket-type polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D 2467 for use with Items 26 and 27	X	
19	Threaded polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D 2464	X	
20	Joints for IPS pvs pipe using solvent cement, ASTM D 2672	X	
21	Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D 2996	X	X
22	Steel pipeline flanges,	X	X

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

		SERVICE	
Item No.	Pipe and Fitting Materials	A	B
	MSS SP-44		
23	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B 828	X	X
24	Carbon steel pipe unions, socket-welding and threaded, MSS SP-83	X	X
25	Malleable-iron threaded pipe unions ASME B16.39	X	X
26	Nipples, pipe threaded ASTM A 733	X	X
27	Crosslinked Polyethylene (PEX) Plastic Pipe ASTM F 877.	X	X

A - Cold Water Service Aboveground

B - Hot and Cold Water Distribution 82 degree C Maximum Aboveground

C - CAir Lubricated

D - Water Service Belowground

Indicated types are minimum wall thicknesses.

** - Type L - Hard

*** - Type K - Hard temper with brazed joints only or type K-soft temper
without joints in or under floors

**** - In or under slab floors only brazed joints

-- End of Section --

SECTION 15556A

FORCED HOT WATER HEATING SYSTEMS USING WATER AND STEAM HEAT EXCHANGERS
02/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 2001) Pipe Threads, General Purpose, Inch
ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.11	(2002) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings
ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings
ASME B31.1	(2001) Power Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPVC SEC IX	(2001) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME BPVC SEC VIII D1	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASTM INTERNATIONAL (ASTM)

ASTM A 105/A 105M	(2002) Carbon Steel Forgings for Piping Applications
ASTM A 106	(2002a) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 193/A 193M	(2003) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 234/A 234M	(2002) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A 366/A 366M	(1997e1) Commercial Steel, Sheet, Carbon, (0.15 Maximum Percent Cold-Rolled**
ASTM A 515/A 515M	(2003) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A 516/A 516M	(2003) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 569/A 569M	(1998) Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip, Commercial
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 733	(2003) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B 62	(2002) Composition Bronze or Ounce Metal Castings
ASTM B 650	(1995; R 2002) Electrodeposited Engineering Chromium Coatings on Ferrous Substrates
ASTM B 687	(1999) Brass, Copper, and Chromium-Plated Pipe Nipples
ASTM D 1384	(2001) Corrosion Test for Engine Coolants

in Glassware

ASTM D 3308 (2001) PTFE Resin Skived Tape

ASTM D 596 (2001) Reporting Results of Analysis of Water

EXPANSION JOINT MANUFACTURERS ASSOCIATION (EJMA)

EJMA Stds (2003) EJMA Standards

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25 (1998) Standard Marking System for Valves, Fittings, Flanges and Unions

MSS SP-58 (2002) Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-69 (2002) Pipe Hangers and Supports - Selection and Application

MSS SP-70 (1998) Cast Iron Gate Valves, Flanged and Threaded Ends

MSS SP-71 (1997) Gray Iron Swing Check Valves, Flanged and Threaded Ends

MSS SP-80 (2003) Bronze Gate, Globe, Angle and Check Valves

MSS SP-85 (2002) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1997) Enclosures for Electrical Equipment (1000 Volts Maximum)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Heating Systems

Detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-03 Product Data

Welding

Six copies of qualified procedures and list of names and identification symbols of qualified welders and welding operators, prior to welding operations.

Framed Instructions

Proposed diagrams, instructions, and other sheets, prior to posting. The instructions shall show wiring and control diagrams and complete layout of the entire system. The instructions shall include, in typed form, condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation and procedures for safely starting and stopping the system.

SD-06 Test Reports

Testing and Cleaning

Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

Water Treatment Testing

The water quality test report shall identify the chemical composition of the heating water. The report shall include a comparison of the condition of the water with the chemical company's recommended conditions. Any required corrective action shall be documented within the report.

SD-07 Certificates

Bolts

Written certification that the bolts furnished comply with the requirements of this specification, provided by the bolt manufacturer. The certification shall include illustrations of

product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

SD-10 Operation and Maintenance Data

Heating Systems

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set, prior to performance testing and the remainder upon acceptance. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, water treatment procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed. Manuals shall be provided prior to the field training course.

1.3 QUALIFICATIONS

Procedures and welders shall be qualified in accordance with the code under which the welding is specified to be accomplished.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Danish products may be used that have not been tested and certified by the standards and requirements listed in paragraph 1.1 of this section as long as the products are of true commercial quality and are safe for the intended use. Danish products shall meet all current, applicable, Danish Safety Codes, standards, and requirements.

2.1.2 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.1.3 Equipment Guards and Access

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded in accordance with OSHA or Danish requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified.

2.1.4 Asbestos Prohibition

Asbestos and asbestos-containing products shall not be used.

2.1.5 Electrical Work

Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electric equipment (including motor efficiencies), and wiring shall be in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. High efficiency motors shall be used. Electrical characteristics shall be as specified or indicated. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified. Each motor shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring, conduit, and connection to power required for controls and devices but not shown shall be provided.

2.2 PIPING, TUBING, AND FITTINGS

2.2.1 General

Piping, tubing, and fittings shall be as follows:

- a. Low temperature water piping shall be black steel with cast iron, or malleable iron or steel fittings.
- b. Steam pipe shall be black steel with malleable iron or steel fittings.
- c. Condensate return piping shall be black steel Schedule 80 with cast iron or malleable iron, Class 250 minimum.
- d. Vent piping shall be black steel, Schedule 40, with black malleable iron fittings.

2.2.2 Steel Pipe

Pipe shall conform to ASTM A 53/A 53M or ASTM A 106, Grade A or B, black steel, Schedule 40, unless otherwise specified. Steam pipe shall be ASTM A 53/A 53M Grade A.

2.2.3 Gauge Piping

Black steel, ASTM A 106, seamless, Grade A pipe.

2.2.4 Malleable Iron Pipe Fittings

Fittings shall conform to ASME B16.3, type required to match adjacent piping.

2.2.5 Cast Iron Pipe Fittings

Fittings shall conform to ASME B16.1 or ASME B16.4 type required to match adjacent piping.

2.2.6 Steel Pipe Fittings

Fittings shall have the manufacturer's trademark affixed in accordance with MSS SP-25 so as to permanently identify the manufacturer.

2.2.6.1 Welded Fittings

Welded fittings shall conform to ASTM A 234/A 234M with WPA marking. Butt welded fittings shall conform to ASME B16.9, and socket welded fittings shall conform to ASME B16.11.

2.2.7 Steel Flanges

Flanged fittings including flanges, bolts, nuts, bolt patterns., etc. shall be in accordance with ASME B16.5 class 150 and shall have the manufacturers trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105/A 105M. Blind flange material shall conform to ASTM A 516/A 516M cold service and ASTM A 515/A 515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193/A 193M.

2.2.8 Pipe Threads

Pipe threads shall conform to ASME B1.20.1.

2.2.9 Nipples

Nipples shall conform to ASTM A 733 or ASTM B 687, standard weight.

2.2.10 Unions

Unions shall conform to ASME B16.39, type to match adjacent piping.

2.2.11 Dielectric Waterways

Dielectric waterways shall conform to the tensile strength and dimensional requirements specified in ASME B16.39. Waterways shall have metal connections on both ends to match adjacent piping. Metal parts of dielectric waterways shall be separated so that the electrical current is below 1 percent of the galvanic current which would exist upon metal-to-metal contact. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways.

2.2.12 Flexible Pipe Connectors

Flexible pipe connectors shall be designed for 1.034 MPa (150 psi) or 1.034 MPa (150 psi) service as appropriate for the static head plus the system head, and 121 degrees C (250 degrees F). Connectors shall be installed where indicated. The flexible section shall be constructed of rubber, tetrafluoroethylene resin, or corrosion-resisting steel, bronze, monel, or galvanized steel. Materials used and the configuration shall be suitable for the pressure, vacuum, temperature, and circulating medium. The flexible section may have threaded, welded, soldered, flanged, grooved, or socket ends. Flanged assemblies shall be equipped with limit bolts to restrict maximum travel to the manufacturer's standard limits. Unless otherwise indicated, the length of the flexible connectors shall be as recommended by the manufacturer for the service intended. Internal sleeves or liners, compatible with circulating medium, shall be provided when recommended by the manufacturer. Covers to protect the bellows shall be provided where indicated.

2.3 MATERIALS AND ACCESSORIES

2.3.1 Iron and Steel Sheets

2.3.1.1 Galvanized Iron and Steel

Galvanized iron and steel shall conform to ASTM A 653/A 653M, with general requirements conforming to ASTM A 653/A 653M. Gauge numbers specified are Manufacturer's Standard Gauge.

2.3.1.2 Uncoated (Black) Steel

Uncoated (black) steel shall conform to ASTM A 366/A 366M or ASTM A 569/A 569M, composition, condition, and finish best suited to the intended use. Gauge numbers specified refer to Manufacturer's Standard Gauge.

2.3.2 Thermometers

Mercury shall not be used in thermometers. Thermometers shall have brass, malleable iron, or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 225 mm (9 inch) scale, and thermometers shall have

rigid stems with straight, angular, or inclined pattern.

2.3.3 Gauges

Gauges shall conform to ASME B40.1.

2.3.4 Gaskets for Flanges

Composition gaskets shall conform to ASME B16.21. Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 6.6 mm (1/16 inch) thickness, full face or self-centering flat ring type. Gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR). NBR binder shall be used for hydrocarbon service. Gaskets shall be suitable for pressure and temperatures of piping system.

2.3.5 Bellows-Type Joints

Joints shall be flexible, guided expansion joints. Expansion element shall be of stainless steel. Bellows-type expansion joints shall be in accordance with the applicable requirements of EJMA Stds and ASME B31.1 with internal liners.

2.3.6 Expansion Joints

Expansion joints shall provide for either single or double slip of connected pipes, as required or indicated, and for not less than the traverse indicated. Joints shall be designed for hot water working pressure not less than 1034 kPa and shall be in accordance with applicable requirements of EJMA Stds and ASME B31.1. Joints shall be designed for packing injection under full line pressure. End connections shall be flanged or beveled for welding as indicated. Joints shall be provided with anchor base where required or indicated. Where adjoining pipe is carbon steel, the sliding slip shall be seamless steel plated with a minimum of 0.0508 mm (2 mils) of hard chrome conforming to ASTM B 650. Joint components shall be fabricated from material equivalent to that of the pipeline. Initial settings shall be made in accordance with manufacturer's recommendations to compensate for ambient temperature at time of installation. Pipe alignment guides shall be installed as recommended by joint manufacturer, but in any case shall not be more than 1.5 m (5 feet) from expansion joint except for lines 100 mm (4 inches) or smaller, guides shall be installed not more than 600 mm (2 feet) from the joint. Service outlets shall be provided where indicated.

2.3.7 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.4 VALVES FOR LOW TEMPERATURE WATER HEATING AND STEAM SYSTEMS

2.4.1 Check Valves

Sizes 65 mm (2-1/2 inches) and less, bronze, and shall conform to MSS SP-80, Type 3 or 4, Class 125. Sizes 80 mm (3 inches) through 300 mm (24 inches),

cast iron, and shall conform to MSS SP-71, Type III or IV, Class 125.

2.4.2 Globe Valves

Sizes 65 mm (2-1/2 inches) and less, bronze, and shall conform to MSS SP-80, Type 1, 2 or 3, Class 125. Sizes 80 mm (3 inches) through 300 mm (12 inches), cast iron, and shall conform to MSS SP-85, Type III, Class 125.

2.4.3 Angle Valves

Sizes 65 mm (2-1/2 inches) and less, bronze, and shall conform to MSS SP-80, Type 1, 2 or 3, Class 125. Sizes 80 mm (3 inches) through 300 mm (12 inches), cast iron, and shall conform to MSS SP-85, Type III, Class 125.

2.4.4 Gate Valves

Sizes 65 mm (2-1/2 inches) and less, bronze, and shall conform to MSS SP-80, Type 1 or 2, Class 125. Sizes 80 mm (3 inches) through 1200 mm (48 inches), cast iron, and shall conform to MSS SP-70, Type I, Class 125, Design OT or OF (OS&Y), bronze trim.

2.4.5 Air Vents

Air vents shall be provided at all piping high points in water systems, with block valve in inlet and internal check valve to allow air vent to be isolated for cleaning and inspection. Outlet connection shall be piped to nearest open site or suitable drain, or terminated 300 mm (12 inches) above finished grade. Pressure rating of air vent shall match pressure rating of piping system. Body and cover shall be cast iron or semi-steel with stainless steel or copper float and stainless steel or bronze internal parts. Air vents installed in piping in chase walls or other inaccessible places shall be provided with an access panel.

2.4.6 Balancing Valves

Balancing valves shall have meter connections with positive shutoff valves.

An integral pointer shall register degree of valve opening. Valves shall be calibrated so that flow in liters per minute (gpm) can be determined when valve opening in degrees and pressure differential across valve is known. Each balancing valve shall be constructed with internal seals to prevent leakage and shall be supplied with preformed insulation. Valves shall be suitable for 121 degrees C (250 degrees F) temperature and working pressure of the pipe in which installed. Valve bodies shall be provided with tapped openings and pipe extensions with shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable meter to measure the pressure differential. One portable differential meter shall be furnished. The meter suitable for the operating pressure specified shall be complete with hoses, vent, and shutoff valves and carrying case. In lieu of the balancing valve with integral metering connections, a ball valve or plug valve with a separately installed orifice plate or venturi tube may be used for balancing.

2.4.7 Radiator Valves

Automatic thermostatic radiator valves shall be self-contained wall thermostat controlled nonelectric temperature control valves. Valve bodies shall be constructed of nickel plated brass and shall be angle or straight pattern as indicated, with threaded oend connections. Gland seal pressure pin to be chromium steel working in a lifetime, lubricated O-ring. The complete gland assembly must be field replaceable without draining down the entire system. Thermostatic operators shall be a modulating type consisting of a sensing unit counter balanced by a spring setting. Valves to be Danfoss.

2.5 COLD WATER CONNECTIONS

Connections shall be provided which include consecutively in line a strainer, backflow prevention device, and water pressure regulator. The backflow prevention device and piping shall be provided as indicated and in compliance with Section 15400A PLUMBING, GENERAL PURPOSE.

2.5.1 Strainers

Basket or Y-type strainers shall be the same size as the pipelines in which they are installed. Strainer bodies shall be rated for 1.72 MPa (250 psi) service, with bottoms drilled and plugged. Bodies shall have arrows cast on the sides to indicate the direction of flow. Each strainer shall be equipped with a removable cover and sediment basket. Basket shall not be less than 0.795 mm (22 gauge) and shall have perforations to provide a net free area through the basket of at least four times that of the entering pipe.

2.5.2 Pressure Regulating Valve

Valve shall be a type that will not stick nor allow pressure to build up on the low side. Valve shall be set to maintain a terminal pressure approximately 35 kPa (5 psi) in excess of the static head on the system and shall operate within a 138 kPa (20 psi) variation regardless of initial pressure and without objectionable noise under any condition of operation.

2.6 EXPANSION TANK

Pressurization system shall include a replaceable diaphragm-type captive air expansion tank which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting this pressure increase at all components in the system to the maximum allowable pressure at those components. The only air in the system shall be the permanent sealed-in air cushion contained in the diaphragm-type tank. Sizes shall be as indicated. Expansion tank shall be welded steel, constructed, tested and stamped in accordance with ASME BPVC SEC VIII D1 for a working pressure of 862 kPa (125 psig) and precharged to the minimum operating pressure. Tank air chamber shall be fitted with an air charging valve. Tank shall be supported by steel legs or bases for vertical installation or steel saddles for horizontal installations.

2.7 AIR SEPARATOR TANK

External air separation tank shall be steel, constructed, tested, and stamped in accordance with ASME BPVC SEC VIII D1 for a working pressure of 862 kPa (125 psi). The capacity of the air separation tank indicated is minimum.

2.8 STEAM TRAPS

2.8.1 Float Traps

Capacity, working pressure, and differential pressure of the traps shall be as indicated.

2.8.2 Float-and-Thermostatic Traps

Traps shall be designed for a maximum operating pressure of approximately 1206 kPa (175 psi), but shall operate with a supply pressure of approximately 448 kPa (65 psig). The capacity of the traps shall be as indicated. Trap capacity shall be based on a pressure differential of 2 kPa (1/4 psi). Each float-and-thermostatic trap shall be provided with a hard bronze, monel, or stainless steel valve seat and mechanism and brass float, all of which can be removed easily for inspection or replacement without disturbing the piping connections. Inlet to each trap shall have a cast iron strainer, either an integral part of the trap or a separate item of equipment.

2.8.3 Bucket Traps

Traps shall be inverted or vertical bucket type with automatic air discharge. Traps shall be designed for a working pressure of 1724 kPa (250 psi), but shall operate under a steam supply pressure of approximately 276 to 690 kPa (40 to 100 psig) as required. Each trap shall have a heavy body and cap of fine-grained, gray cast iron. The bucket shall be made of brass; the mechanism of hard bronze; the valve and seat of stainless or monel; or each of equivalent material. Traps shall be tested hydrostatically under a pressure of at least 1.38 MPa (200 psig). Traps shall have capacities as indicated when operating under the specified working conditions. A strainer shall be installed in the suction connection of each trap. Impact operated traps, impulse-operated traps, or thermodynamic traps with continuous discharge may be installed in lieu of bucket traps, subject to approval. Thermostatic traps designed for a steam working pressure suitable for the application may be furnished in lieu of the traps specified above. Thermostatic traps shall be equipped with valves and seats of stainless steel or monel metal, and shall have capacities based on a pressure differential not in excess of the following:

Steam Working Pressure, kPa (psi)	Differential, kPa (psi)
172 - 345 (25-50)	138 (20)
621 - 689 (90-100)	552 (80)

2.9 HEAT EXCHANGERS

Heat exchangers shall be single pass vertical shell and coil type or plate and frame type as indicated, to provide low temperature hot water and low temperature glycol/water mix for the heating systems. Temperature and pressure for shell and coil exchangers shall not exceed 170 degrees C (338 degrees F) and 689 kPa (100 psig) for steam. Exchangers shall be constructed to meet ASME BPVC SEC VIII D1 and be capable of being certified with ASME stamp secured to unit. Coils shall be completely removable for cleaning and replacement and shall be free to expand with shell. Shells shall be of seamless steel pipe or welded steel construction and coils shall be seamless tubing as specified below unless otherwise indicated. Connections shall be leakproof. Legs shall be provided to mount shell and coil exchangers.

2.9.1 Steam Heat Exchangers, Shell and Coil Type

Exchangers shall operate with steam in coils and low temperature water in shell. Steam coils shall be designed for 25 bar (360 psig) working pressure at up to 300 degrees C (572 degrees F) and factory tested at 33 bar (480 psig). Shell waterside shall be designed for 6.5 bar (94 psig) working pressure at up to 120 degrees C (248 degrees F) and factory tested to 10 bar (145 psig). Steam, water, condensate, and vacuum and pressure relief valve connections shall be located in accordance with the manufacturer's standard practice. Connections larger than 80 mm (3 inches) shall be equal to ASME 1.03 MPa (150 pounds) flanged. Coils shall be seamless stainless steel, constructed in accordance with current, applicable Danish safety standards, suitable for the temperatures and pressures specified. Maximum steam inlet nozzle velocity shall not exceed 30.5 m/second (6000 fpm). Other features of shell and coil heat exchangers to be as follows:

- a. Pre-piped on the water side with shut-off valves, thermometers and pressure gages, drains and vents, dual security valves, flanges, sensors, and thermostat/controller.
- b. Pre-piped on steam/condensate side with flanges, shut-off valves, non-return valves, condensate line trap and Cloris temperature controller, sensors, Cloris motorized security valve and manometer.
- c. DDC controller will be capable of operating heat exchanger after receiving an enable signal from the building DDC system.

2.9.2 Liquid-to-Liquid Heat Exchangers, Plate and Frame Type

Plates, frames and gaskets shall be designed for a working pressure of 10.4 bar MPa (150 psig) and factory tested at 10.4 bar (450 psig). Water and relief valve connections shall be located in accordance with the manufacturer's standard practice. Connections larger than 80 mm (3 inches) shall be equal to ASME 4.03 MPa (150 pound) flanged. Plates shall be Type 316L stainless steel with copper foil sealing or better. Unit to be ASME designed, tested and stamped. Unit to be fully welded or brazed or soldered tight.

2.10 SYSTEM EQUIPMENT AND ACCESSORIES

2.10.1 Circulating Pumps

Pumps for hot water shall be of the single-stage centrifugal type, electrically driven. Pumps shall be supported by the piping on which installed. Pumps shall be either integrally mounted with the motor or direct-connected by means of a coupling. Pump housing shall be of close grained cast iron. Shaft shall be stainless steel, turned and ground. Shaft seal shall be tungsten carbide mechanical type. Impeller, impeller wearing rings, glands, casing wear rings, and shaft sleeve shall be stainless steel. Bearings shall be ball-, roller-, or oil-lubricated, bronze-sleeve type, and shall be sealed or isolated to prevent loss of oil or entrance of dirt or water. Motor shall be of a type approved by the manufacturer of the pump.

2.10.2 Pressure Gauges and Thermometers

Gauges shall be provided for each heat exchanger and piping as indicated. A thermometer and pressure gauge shall be provided on the water and glycol/water supply and return mains. Thermometers shall be separable socket type.

2.10.3 Vacuum Relief Valve

Vacuum relief valve shall be installed as indicated. On shutoff of steam supply and condensing of steam, the vacuum relief valve shall automatically admit air to the heat exchanger.

2.10.4 Heat Exchanger Pressure Relief Valves

One or more pressure relief valves shall be provided for each heat exchanger in accordance with current, applicable, Danish Safety Codes. The aggregate relieving capacity of the relief valves shall be not less than that required by the above code. Discharge from the valves shall be installed as indicated. Pressure relief valves for steam heat exchangers shall be located on the low temperature water supply coming from near the heat exchanger as indicated.

2.10.5 Drains

A drain connection with 20 mm (3/4 inch) hose bib shall be installed at the lowest points in the water and glycol/water return main near the heat exchanger. In addition, threaded drain connections with threaded cap or plug shall be installed wherever required for thorough draining of the systems.

2.10.6 Strainers

Basket or Y-type strainer-body connections shall be the same size as the pipe lines in which the connections are installed. The bodies shall have arrows clearly cast on the sides to indicate the direction of flow. Each strainer shall be equipped with an easily removable cover and sediment basket. The body or bottom opening shall be equipped with nipple and gate

valve for blowdown. The basket for steam systems shall be of not less than 0.635 mm (0.025 inch) thick stainless steel, or monel with small perforations of sufficient number to provide a net free area through the basket of at least 2.5 times that of the entering pipe. The flow shall be into the basket and out through the perforations. The strainer bodies for steam systems shall be of cast steel or gray cast iron with bottoms drilled and plugged.

2.10.7 Low Temperature Water System Relief Valves

Relief valves to have ASTM A 536 Ductile iron or ASTM B 62 Bronze bodies and covers with screwed or flanged ends. Trim to be stainless steel, disc to be Buna-N rubber, and diaphragm to be nylon reinforced Buna-N rubber. Valves to be pilot operated and are to have check valves and opening speed control. Valves to be self-contained and completely automatic. Valves to be Cla-Val model 55F or equal.

2.10.8 Steam System Relief Valves

Steam relief valves shall be suitable for steam service per the requirements of ASME Section I and VIII. Valves shall be carbon steel with pressure rating greater than 31 bar (300 psig) and temperature rating greater than of 400 Deg C. (750 Deg F). Valves shall be self contained and completely automatic. Valves to Crosby style HS or equal.

2.11 INSULATION

Shop and field applied insulation shall be as specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.12 FACTORY PAINTED EXPOSED SPACE HEATING EQUIPMENT

Radiator and convector enclosures shall be coated with the manufacturer's standard rust inhibiting primer and shall be painted at the factory with the manufacturer's powder paint finish.

2.13 RADIATORS

The radiators shall be the type and size indicated. The supply and return connections shall be the same size. Radiators shall be tested hydrostatically at the factory and proved tight under a pressure of not less than 13 bar kPa (188 psig). A certified report of these tests shall be furnished in accordance with paragraph SUBMITTALS.

2.13.1 Radiators

The radiators are to be produced from steel plate FePol AM, profiled in a modern design with 33-1/3 mm intervals. Type 20s, 21s, 22 and 33 are to be delivered with top grilles and side panels. Radiators are to be equipped with attractive straps or brackets for mounting.

Rated working pressure to be 10 bar.

Units to be shipped in environmental friendly cartons and polyethylene

shrink-wrap, allowing installation of the radiator without removing the packaging. The packaging is to protect the radiator until after final cleaning of the room.

All radiators are to be fully guaranteed for 5 years from date of installation against all defects caused by faulty materials and workmanship.

Radiators to come complete with pre-piped downcomer's, and Danfoss RA-N control valves with Danfoss RA-2000 series thermostatic sensors with remote, wall-mounted adjusters.

2.14 UNIT HEATERS

Heaters shall be as specified below, and shall have a heating capacity not in excess of 125 percent of the capacity indicated.

2.14.1 Propeller Fan Heaters

Heaters shall be designed for suspension and arranged for horizontal discharge of air as indicated. Casings shall be not less than 0.912 mm (20 gauge) black steel and finished with lacquer or enamel. Suitable deflectors shall be provided to assure proper air and heat distribution. Suspension from heating pipes will not be permitted.

2.14.2 Heating Elements

Heating coils and radiating fins shall be of suitable nonferrous alloy with brazed fittings at each end for connecting to external piping. The heating elements shall be free to expand or contract without developing leaks and shall be properly pitched for drainage. The elements shall be tested under a hydrostatic pressure of 1.38 MPa (200 psig) and a certified report of the test shall be submitted to the Contracting Officer. Coils shall be suitable for use with water up to 121 degrees C (250 degrees F).

2.14.3 Motors

Motors shall be provided with NEMA 250 general purpose enclosure. Motors and motor controls shall otherwise be as specified in Section 16415A ELECTRICAL WORK, INTERIOR.

2.14.4 Motor Switches

Motors shall be provided with manual selection switches with "Off," and "Automatic" positions and shall be equipped with thermal overload protection.

2.14.5 Controls

Controls shall be provided as specified in Section 15951A DIRECT DIGITAL CONTROL FOR HVAC.

2.15 WATER TREATMENT SYSTEM

The water treatment system shall be capable of manually feeding chemicals

into the heating systems to prevent corrosion and scale within the heat exchangers and piping systems. All water treatment equipment and chemicals shall be furnished and installed by a water treatment company regularly engaged in the installation of water treatment equipment and the provision of water treatment chemicals based upon water condition analyses. The water treatment company shall provide a water sample analysis taken from the building site, each month for one year.

2.15.1 Chemical Shot Feeder

A shot feeder shall be provided as indicated. Size and capacity of feeder shall be based upon local requirements and water analysis. The feeder shall be furnished with an air vent, gauge glass, funnel, valves, fittings, and piping. All materials of construction shall be compatible with the chemicals being used.

2.15.2 Make Up Water Analysis

The make up water pH reported by base personnel is 8.5.

2.15.3 Chemicals

The chemical company shall provide pretreatment chemicals that will remove and permit flushing of mill scale, oil, grease, and other foreign matter from the water heating system. The chemical company shall also provide all treatment chemicals required for the initial fill of the system and for a period of one year of operation. The chemical company shall determine the correct chemicals and concentrations required for the water treatment. The chemicals shall not be proprietary and shall meet required federal, state, and local environmental regulations for the treatment of heating water systems and discharge to the sanitary sewer. The chemicals shall remain stable throughout the operating temperature range of the system, and shall be compatible with pump seals and other elements of the system.

2.15.4 Glycol Solutions

A 60 percent concentration by volume of industrial grade propylene glycol shall be provided for the ventilation unit preheat coil system. The glycol shall be tested in accordance with ASTM D 1384 with less than 0.013 mm (0.5 mils) penetration per year for all system metals. The glycol shall contain corrosion inhibitors. Silicate based inhibitors shall not be used.

The solution shall be compatible with pump seals, other elements of the system, and all water treatment chemicals used within the system.

2.15.5 Test Kits

All required test kits and reagents for determining the proper water conditions shall be provided.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as indicated and in accordance with the

manufacturer's diagrams and recommendations.

3.2 COLOR CODE MARKING AND FIELD PAINTING

Color code marking, field painting of exposed pipe, and field painting of factory primed equipment shall be as specified in Section 09900 PAINTS AND COATINGS.

3.3 WELDING

Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practical. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record.

3.4 PIPING

Unless otherwise specified, pipe and fittings installation shall conform to the requirements of ASME B31.1. Pipe shall be cut accurately to measurements established at the job site and worked into place without springing or forcing, completely clearing all windows, doors, and other openings. Cuttings or other weakening of the building structure to facilitate piping installation will not be permitted without written approval. Pipe or tubing shall be cut square, shall have burrs removed by reaming, and shall be so installed as to permit free expansion and contraction without causing damage to building structure, pipe, joints, or hangers. Changes in direction shall be made with factory made fittings, except that bending of pipe up to 100 mm (4 inches) will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center line radius of bends shall not be less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be accepted. Vent pipes shall be installed through the roof as indicated and shall be flashed as specified. Horizontal mains shall pitch up or down in the direction of flow as indicated. The grade shall be not less than 25 mm in 12 m (1 inch in 40 feet). Reducing fittings shall be used for changes in pipe sizes. Open ends of pipelines and equipment shall be capped or plugged during installation to keep dirt or other foreign materials out of the systems. Pipe not otherwise specified shall be uncoated. Unions and other components for copper pipe or tubing shall be brass or bronze. Connections between ferrous and copper piping shall be electrically isolated using dielectric unions.

3.4.1 Joints

Except as otherwise specified, joints used on steel pipe shall be threaded for fittings 25 mm (1 inch) and smaller; threaded or welded for 32 mm (1-1/4 inches) up through 65 mm (2-1/2 inches); and flanged or welded for 80 mm (3 inches) and larger. Pipe and fittings 32 mm (1-1/4 inches) and larger installed in inaccessible conduits or trenches beneath concrete

floor slabs shall be welded. Unless otherwise specified, connections to equipment shall be made with black malleable iron unions for pipe 65 mm (2-1/2 inches) or smaller in diameter, and with flanges for pipe 80 mm (3 inches) or larger in diameter.

3.4.2 Low Temperature Systems

Piping may have threaded, welded, or flanged mechanical joints as applicable and as specified. Reducing fittings shall be used for changes in pipe sizes. In horizontal lines, reducing fittings shall be the eccentric type to maintain the top of the adjoining pipes at the same level.

3.4.3 Steam Systems

Piping may have threaded, welded, or flanged joints as applicable and as specified. Reducing fittings shall be used for changes in pipe sizes. In horizontal steam lines, reducing fittings shall be the eccentric type to maintain the bottom of the lines at the same level.

3.4.4 Threaded Joints

Threaded joints shall be made with tapered threads properly cut, and shall be made tight with PTFE tape complying with ASTM D 3308, or equivalent thread joint compound applied to the male threads only, and in no case to the fittings.

3.4.5 Welded Joints

Joints shall be fusion-welded unless otherwise required. Changes in direction of piping shall be made with welding fittings only. Branch connection may be made with either welding tees or branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains.

3.4.6 Flanged Joints or Unions

Flanged joints or unions shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and similar items. Flanged joints shall be faced true, provided with gaskets, and made square and tight. Full-faced gaskets shall be used with cast iron flanges.

3.5 CONNECTIONS TO EQUIPMENT

Supply and return connections shall be provided by the Contractor unless otherwise indicated. Valves and traps shall be installed in accordance with the manufacturer's recommendations. Unless otherwise indicated, the size of the supply and return pipes to each piece of equipment shall be not smaller than the connections on the equipment. No bushed connections shall be permitted. Change in sizes shall be made with reducers or increasers only.

3.5.1 Low Temperature Water and Steam and Return Connections

Connections, unless otherwise indicated, shall be made with malleable iron unions for piping 65 mm (2-1/2 inches) or less in diameter and with flanges for pipe 80 mm (3 inches) or more in diameter.

3.6 BRANCH CONNECTIONS

Branches shall pitch up or down as indicated, unless otherwise specified. Connection shall be made to insure unrestricted circulation, eliminate air pockets, and permit drainage of the system.

3.6.1 Low Temperature Water Branches

Branches taken from mains shall pitch with a grade of not less than 25 mm in 3 m (1 inch in 10 feet).

3.6.2 Steam Supply and Condensate Branches

Branches taken from mains shall pitch with a grade of not less than 25 mm in 3 m (1 inch in 10 feet), unless otherwise indicated.

3.7 RISERS

The location of risers is approximate. Exact locations of the risers shall be as approved.

3.8 SUPPORTS

3.8.1 General

Hangers used to support piping 50 mm (2 inches) and larger shall be fabricated to permit adequate adjustment after erection while supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. All piping subjected to vertical movement when operating temperatures exceed ambient temperatures, shall be supported by variable spring hangers and supports or by constant support hangers. Where threaded rods are used for support, they shall not be formed or bent.

3.8.1.1 Structural Attachments

Structural steel brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section. Material and installation shall be as specified under Section 05120 STRUCTURAL STEEL. Pipe hanger loads suspended from steel joist panel points shall not exceed 222 N (50 pounds). Loads exceeding 222 N (50 pounds) shall be suspended from panel points.

3.8.1.2 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member.

Spacing of the base support members shall not exceed the hanger and support spacing required for any individual pipe in the multiple pipe run.

3.8.2 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as specified as follows:

- a. Types 5, 12, and 26 shall not be used.
- b. Type 3 shall not be used on insulated pipe which has a vapor barrier. Type 3 may be used on insulated pipe that does not have a vapor barrier if clamped directly to the pipe and if the clamp bottom does not extend through the insulation and the top clamp attachment does not contact the insulation during pipe movement.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for Type 18 inserts.
- d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
- e. Type 20 attachments used on angles and channels shall be furnished with an added malleable iron heel plate or adapter.
- f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.
- g. Where Type 39 saddle or Type 40 shield are permitted for a particular pipe attachment application, the Type 39 saddle shall be used on all pipe 100 mm (4 inches) and larger.
- h. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 300 mm (1 foot) from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 m (5 feet) apart at valves.
- i. Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 4.5 m (15 feet), except that pipe shall be supported not more than 2.4 m (8 feet) from end of risers, and at vent terminations.
- j. Type 35 guides using steel, reinforced PTFE or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions and bearing loads encountered. Where steel slides do not require provision for restraint or lateral movement, an alternate guide method may be used. On piping 100 mm (4 inches) and larger, a Type 39 saddle may be welded to the pipe and freely

rest on a steel plate. On piping under 100 mm (4 inches), a Type 40 protection shield may be attached to the pipe or insulation and freely rest on a steel slide plate. Where there are high system temperatures and welding to piping is not desirable, then the Type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 100 mm (4 inches), or by an amount adequate for the insulation, which ever is greater.

- k. Except for Type 3, pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation.

3.9 PIPE SLEEVES

3.9.1 Pipe Passing Through Concrete or Masonry

Pipe passing through concrete or masonry walls or concrete floors shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall not be installed in structural members except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface. Unless otherwise indicated, sleeves shall provide a minimum of 6 mm (1/4 inch) annular space between bare pipe or insulation surface and sleeves. Sleeves in bearing walls, waterproofing membrane floors, and wet areas shall be steel pipe or cast iron pipe. Sleeves in nonbearing walls, floors, or ceilings may be steel pipe, cast iron pipe, or galvanized sheet metal with lock-type longitudinal seam and of the metal thickness indicated. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over insulation and sleeve in nonfire rated walls and floors shall be sealed as indicated and specified in Section 07920 JOINT SEALANTS. Penetrations in fire walls and floors shall be sealed in accordance with Section 07840 FIRESTOPPING.

3.9.2 Pipes Passing Through Waterproofing Membranes

Pipes passing through waterproofing membranes shall be installed through a 19.5 kg/square meter (4 pound) lead-flashing sleeve, a 4.9 kg/square meter (16 ounce) copper sleeve, or a 0.813 mm (0.032 inch) thick aluminum sleeve, each having an integral skirt or flange. Flashing sleeve shall be suitably formed, and the skirt or flange shall extend 200 mm (8 inches) or more from the pipe and shall be set over the roof or floor membrane in a troweled coating of bituminous cement. The flashing sleeve shall extend up the pipe a minimum of 50 mm (2 inches) above the highest flood level of the roof or a minimum of 250 mm (10 inches) above the roof, whichever is greater, or 250 mm (10 inches) above the floor. The annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation shall be sealed as indicated. At the Contractor's option, pipes up to and including 250 mm (10 inches) in diameter passing through roof or floor waterproofing membrane may be installed through a cast iron sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess.

3.9.3 Mechanical Seal Assembly

In lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve or conduit and sleeve, a modular mechanical type sealing assembly may be installed. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved. The Contractor electing to use the modular mechanical type seals shall provide sleeves of the proper diameters.

3.9.4 Counterflashing Alternate

As an alternate to caulking and sealing the annular space between the pipe and flashing sleeve or metal-jacket-covered insulation and flashing sleeve, counterflashing may be by standard roof coupling for threaded pipe up to 150 mm (6 inches) in diameter; lead-flashing sleeve for dry vents and turning the sleeve down into the pipe to form a waterproof joint; or tack-welded or banded-metal rain shield round the pipe and sealing as indicated.

3.9.5 Waterproofing Clamping Flange

Pipe passing through wall waterproofing membrane shall be sleeved as specified. In addition, a waterproofing clamping flange shall be installed as indicated.

3.9.6 Fire Seal

Where pipes pass through fire walls, fire partitions, fire rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07840 FIRESTOPPING.

3.9.7 Escutcheons

Escutcheons shall be provided at all finished surfaces where exposed piping, bare or covered, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe sleeves or to extensions of sleeves without any part of sleeves being visible. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheons shall be chromium-plated iron or chromium-plated brass, either one-piece or split pattern, held in place by internal spring tension or setscrew.

3.10 ANCHORS

Anchors shall be provided where necessary or indicated to localize expansion or prevent undue strain on piping. Anchors shall consist of

heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed using turnbuckles where required. Supports, anchors, or stays shall not be attached in places where construction will be damaged by installation operations or by the weight or expansion of the pipeline.

3.11 PIPE EXPANSION

The expansion of supply and return pipes shall be provided for by changes in the direction of the run of pipe, by expansion loops, or by expansion joints as indicated. Low temperature water and steam expansion joints may be one of the types specified.

3.11.1 Expansion Loops

Expansion loops shall provide adequate expansion of the main straight runs of the system within the stress limits specified in ASME B31.1. The loops shall be cold-sprung and installed where indicated. Pipe guides shall be provided as indicated.

3.11.2 Slip-Tube Joints

Slip-tube type expansion joints shall be used for steam and low temperature water systems only and shall be installed where indicated. The joints shall provide for either single or double slip of the connected pipes as indicated and for the traverse indicated. The joints shall be designed for a working temperature and pressure suitable for the application and in no case less than 1034 kPa. The joints shall be in accordance with applicable requirements of EJMA Stds and ASME B31.1. End connections shall be flanged. Anchor bases or support bases shall be provided as indicated or required. Initial setting shall be made in accordance with the manufacturer's recommendations to allow for ambient temperature at time of installation. Pipe alignment guides shall be installed as recommended by the joint manufacturer, but in any case shall be not more than 1.5 m (5 feet) from expansion joint, except in lines 100 mm (4 inches) or smaller where guides shall be installed not more than 600 mm (2 feet) from the joint.

3.11.3 Bellows-Type Joint

Bellows-type joint design and installation shall comply with EJMA Stds standards. The joints shall be designed for the working temperature and pressure suitable for the application and shall be not less than 1.03 MPa (150 psig) in any case.

3.12 VALVES AND EQUIPMENT ACCESSORIES

3.12.1 Valves and Equipment

Valves shall be installed at the locations shown or specified, and where required for the proper functioning of the system as directed. Gate valves shall be used unless otherwise indicated, specified, or directed. Valves shall be installed with their stems horizontal to or above the main body of the valve. Valves used with ferrous piping shall have threaded or flanged

ends and sweat-type connections for copper tubing.

3.12.2 Thermometer Socket

A thermometer well shall be provided in each return line for each circuit in multicircuit systems.

3.12.3 Air Vents

Vents shall be installed where indicated, and on all high points and piping offsets where air can collect or pocket.

3.12.3.1 Steam Air Vents

Steam air vents shall be a quick-acting valve that continuously removes air. Valve shall be constructed of corrosion-resisting metal, shall be designed to withstand the maximum piping system pressure, and shall automatically close tight to prevent escape of steam and condensate. Vent shall be provided with a manual isolation valve. A vent shall be provided on the shell of each steam heat exchanger.

3.13 STEAM TRAPS

Traps shall be installed in the condensate lines as indicated.

3.14 UNIT HEATERS

Unit heaters shall be installed as indicated and in accordance with the manufacturer's instructions.

3.15 INSULATION

Thickness of insulation materials for piping and equipment and application shall be in accordance with Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.16 TESTING AND CLEANING

3.16.1 Pressure Testing

The Contractor shall notify the Contracting Officer 7 days before the tests are to be conducted. The tests shall be performed in the presence of the Contracting Officer. The Contractor shall furnish all instruments and personnel required for the tests. Electricity, steam, and water will be furnished by the Government. All test results shall be accepted before thermal insulation is installed. The entire low temperature heating system, including heat exchanger, radiators and fittings, shall be hydrostatically tested and proved tight under a pressure of 310 kPa (45 psig) for a period of four hours.

3.16.2 Test of Backflow Prevention Assemblies

Backflow prevention assemblies shall be tested in accordance with Section 15400A PLUMBING, GENERAL PURPOSE.

3.16.3 Cleaning

After the hydrostatic and backflow prevention tests have been made and prior to the operating tests, the heat exchanger and piping shall be thoroughly cleaned by filling the system with a solution of 0.5 kg (1 pound) of caustic soda or 0.5 kg (1 pound) of trisodium phosphate per 200 L (50 gallons) of water. Observe the proper safety precautions in the handling and use of these chemicals. The water shall be heated to approximately 66 degrees C (150 degrees F), and the solution circulated in the system for a period of 48 hours, then drained and the system thoroughly flushed out with fresh water. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. The Contractor shall be responsible for maintaining the system in a clean condition until final acceptance. Bearings shall be lubricated with oil or grease as recommended by the manufacturer.

3.16.4 Water Treatment Testing

3.16.4.1 Water Quality Test

The heating water shall be analyzed prior to the acceptance of the facility and a minimum of twice for a period of one year by the water treatment company. The analysis shall include the following information recorded in accordance with ASTM D 596.

Date of Sample	[_____]
Temperature	[_____] degrees C
Silica (SiO ₂)	[_____] ppm (mg/l)
Insoluble	[_____] ppm (mg/l)
Iron and Aluminum Oxides	[_____] ppm (mg/l)
Calcium (Ca)	[_____] ppm (mg/l)
Magnesium (Mg)	[_____] ppm (mg/l)
Sodium and Potassium (Na and K)	[_____] ppm (mg/l)
Carbonate (HCO ₃)	[_____] ppm (mg/l)
Sulfate (SO ₄)	[_____] ppm (mg/l)
Chloride (Cl)	[_____] ppm (mg/l)
Nitrate (NO ₃)	[_____] ppm (mg/l)
Turbidity	[_____] unit
pH	[_____]
Residual Chlorine	[_____] ppm (mg/l)
Total Alkalinity	[_____] ppm (meq/l)
Noncarbonate Hardness	[_____] epm (meq/l)
Total Hardness	[_____] epm (meq/l)
Dissolved Solids	[_____] ppm (mg/l)
Fluorine	[_____] ppm (mg/l)
Conductivity	[_____] microsiemens/cm

3.17 TESTING, ADJUSTING AND BALANCING

Except as specified herein, testing, adjusting, and balancing shall be in accordance with Section 15990A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

3.18 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

3.19 FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system.

3.20 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 24 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the approved operation and maintenance manuals.

-- End of Section --

SECTION 15895

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM
11/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

- | | |
|----------|--|
| AMCA 210 | (1999) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating |
| AMCA 300 | (1996) Reverberant Room Method for Sound Testing of Fans |

AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

- | | |
|-----------------|--|
| ARI 410 | (2001; Addendum 2002) Forced-Circulation Air-Cooling and Air-Heating Coils |
| ARI Guideline D | (1996) Application and Installation of Central Station Air-Handling Units |

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

- | | |
|---------|--|
| ABMA 11 | (1990; R 1999) Load Ratings and Fatigue Life for Roller Bearings |
| ABMA 9 | (1990; R 2000) Load Ratings and Fatigue Life for Ball Bearings |

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

- | | |
|-------------|---|
| ASHRAE 52.2 | (1999) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size |
| ASHRAE 70 | (1991) Method of Testing for Rating the Performance of Air Outlets and Inlets |

ASTM INTERNATIONAL (ASTM)

- | | |
|-------------------|--|
| ASTM A 123/A 123M | (2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
|-------------------|--|

ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 924/A 924M	(1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B 117	(2002) Operating Salt Spray (Fog) Apparatus
ASTM C 1071	(2000) Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
ASTM C 553	(2002) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 916	(1985; R 2001e1) Adhesives for Duct Thermal Insulation
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 3359	(2002) Measuring Adhesion by Tape Test
ASTM D 520	(2000) Zinc Dust Pigment
ASTM E 84	(2003) Surface Burning Characteristics of Building Materials

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1998) Motors and Generators
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2002) Installation of Air Conditioning and Ventilating Systems
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SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA HVAC Duct Const Stds	(1995; Addenda Nov 1997; 6th Printing 2001) HVAC Duct Construction Standards - Metal and Flexible
SMACNA Leakage Test Mnl	(1985; 6th Printing 1997) HVAC Air Duct Leakage Test Manual

UNDERWRITERS LABORATORIES (UL)

UL 214	(1997; Rev thru Aug 2001) Tests for Flame-Propagation of Fabrics and Films
UL 723	(1996; Rev thru Sep 2001) Test for Surface Burning Characteristics of Building Materials
UL 900	(1994; Rev thru Oct 1999) Air Filter Units
UL Bld Mat Dir	(2003) Building Materials Directory

1.2 COORDINATION OF TRADES

Ductwork, piping offsets, fittings, and accessories shall be furnished as required to provide a complete installation and to eliminate interference with other construction.

1.3 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.4 FIELD MEASUREMENTS

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings; G
Installation; G

Drawings showing equipment layout, including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications; and piping layout showing the location of all guides and anchors, the load imposed on each support or anchor,

and typical support details. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

SD-03 Product Data

Components and Equipment

Manufacturer's catalog data included with the detail drawings for the following items. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with contract requirements for the following:

- a. Piping Components
- b. Ductwork Components
- c. Air Systems Equipment
- d. Air Handling Units
- e. Energy Recovery Devices

Diagrams; G

Proposed diagrams, at least 2 weeks prior to start of related testing. System diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

Manufacturer's Experience

Statement demonstrating successful completion of similar services on at least 5 projects of similar size and scope, at least 2 weeks prior to submittal of other items required by this section.

Performance Tests; G

Proposed test schedules for hydrostatic test of piping, ductwork leak test, and performance tests, at least 2 weeks prior to the start of related testing.

Field Training; G

Proposed schedule for field training, at least 2 weeks prior to the start of related training.

SD-06 Test Reports

Performance Tests Testing, Adjusting, and Balancing

Test reports for the piping hydrostatic test, ductwork leak test, and performance tests in booklet form, upon completion of testing. Reports shall document phases of tests performed including initial test summary, repairs/adjustments made, and final test results.

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Components and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years before bid opening. The 2-year manufacturer's experience shall include applications of components and equipment under similar circumstances and of similar size. The 2 years must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization. Danish products may be used that have not been tested and certified by the standards and requirements listed on paragraph 1.1 of this section as long as the products are of true commercial quality and are safe for the intended use. Danish products shall meet all current, applicable, Danish Safety Codes, standards, and requirements.

2.2 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products shall not be used.

2.3 NAMEPLATES

Equipment shall have a nameplate installed by the manufacturer that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.4 EQUIPMENT GUARDS AND ACCESS

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded according to OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified. Catwalks, operating platforms, ladders, and/or guardrails shall be provided where required and shall be constructed according to Section 05500A MISCELLANEOUS METAL.

2.5 ELECTRICAL WORK

Electrical motor-driven equipment specified shall be provided complete with motor, motor starter, and controls. Unless otherwise specified, electric equipment, including wiring and motor efficiencies, shall be according to Section 16415A ELECTRICAL WORK, INTERIOR. Electrical characteristics and enclosure type shall be as shown. Unless otherwise indicated, motors of 745 W and above shall be high efficiency type. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary. Each motor shall be according to NEMA MG 1 and shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices, but not shown, shall be provided. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controller may be provided to accomplish the same function. Adjustable frequency drives shall be used as indicated.

2.6 CONTROLS

Controls shall be provided as specified in Section 15951A DIRECT DIGITAL CONTROL FOR HVAC.

2.7 DUCTWORK COMPONENTS

2.7.1 Metal Ductwork

All aspects of metal ductwork construction, including all fittings and components, shall comply with SMACNA HVAC Duct Const Stds unless otherwise specified. Elbows shall be radius type with a centerline radius of 1.5 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used. Static pressure Class 125 and 250 Pa (1/2 and 1 inch w.g.) ductwork shall meet the requirements of Seal Class B. Class 500 through 2500 Pa (2 through 10 inch w.g.) shall meet the requirements of Seal Class A. Sealants shall

conform to fire hazard classification specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS and shall be suitable for the range of air distribution and ambient temperatures that it will be exposed to. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct, and flat oval shall be made with duct sealant and locked with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA HVAC Duct Const Stds. The sealant shall be applied to the exposed male part of the fitting collar so that the sealer will be on the inside of the joint and fully protected by the metal of the duct fitting. One brush coat of the sealant shall be applied over the outside of the joint to at least 50 mm (2 inch) band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar will not be acceptable. Outdoor air intake ducts and plenums shall be fabricated with watertight soldered or brazed joints and seams. Lindab manufactured ductwork may be used. Submit ductwork shop drawings.

Dryer vent ducts to be aluminum, and are to be completely sealed.

2.7.1.1 Transitions

Diverging air flow transitions shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees. Transitions for converging air flow shall be made with each side pitched in a maximum of 30 degrees, for an included angle of 60 degrees, or shall be as indicated. Factory-fabricated reducing fittings for systems using round duct sections when formed to the shape of the ASME short flow nozzle, need not comply with the maximum angles specified.

2.7.1.2 General Service Duct Connectors

A flexible duct connector approximately 150 mm (6 inches) in width shall be provided where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, the flexible material shall be secured by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, the flexible material locked to metal collars shall be installed using normal duct construction methods. The composite connector system shall comply with UL 214 and be classified as "flame-retarded fabrics" in UL Bld Mat Dir.

2.7.2 Ductwork Accessories

2.7.2.1 Duct Access Doors

Access doors shall be provided in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system, and unless otherwise shown, shall conform to SMACNA HVAC Duct Const Stds. Access doors shall be provided upstream and downstream of air flow measuring primaries and heating and cooling coils. Doors shall be minimum 375 x 450 mm (15 c 18 inches), unless otherwise shown. Where duct size will not accommodate this size door, the doors shall be made as large as practicable. Doors 600 x 600 mm (24 x 24 inches) or larger shall be provided with fasteners operable from both sides. Doors in insulated ducts shall be the insulated type.

2.7.2.2 Splitters and Manual Balancing Dampers

Splitters and manual balancing dampers shall be furnished with accessible operating mechanisms. Where operators occur in finished portions of the building, operators shall be chromium plated with all exposed edges rounded. Splitters shall be operated by quadrant operators or 5 mm (3/16 inch) rod brought through the side of the duct with locking setscrew and bushing. Two rods are required on splitters over 200 mm (8 inches). Manual volume control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be 2 gauges heavier than the duct in which installed. Unless otherwise indicated, multileaf dampers shall be opposed blade type with maximum blade width of 300 mm (12 inches). Access doors or panels shall be provided for all concealed damper operators and locking setscrews. Unless otherwise indicated, the locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with stand-off mounting brackets, bases, or adapters to provide clearance between the duct surface and the operator not less than the thickness of the insulation. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer. Volume dampers shall be provided where indicated.

2.7.2.3 Air Deflectors and Branch Connections

Air deflectors shall be provided at duct mounted supply outlets, at takeoff or extension collars to supply outlets, at duct branch takeoff connections, and at 90 degree elbows, as well as at locations as indicated on the drawings or otherwise specified. Conical branch connections or 45 degree entry connections may be used in lieu of deflectors or extractors for branch connections. All air deflectors, except those installed in 90 degree elbows, shall be provided with an approved means of adjustment. Adjustment shall be made from easily accessible means inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, external adjustments shall be provided with stand-off mounting brackets, integral with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Air deflectors shall be factory-fabricated units consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Air deflectors shall be factory or field assembled. Blade air deflectors, also called blade air extractors, shall be approved factory fabricated units consisting of equalizing grid and adjustable blade and lock. Adjustment shall be easily made from the face of the diffuser or by position adjustment and lock external to the duct. Stand-off brackets shall be provided on insulated ducts and are described herein. Fixed air deflectors, also called turning vanes, shall be provided in 90 degree elbows.

2.7.3 Duct Sleeves, Framed Prepared Openings, Closure Collars

2.7.3.1 Duct Sleeves

Duct sleeves shall be provided for round ducts 375 mm (15 inches) in

diameter or less passing through floors, walls, ceilings, or roof, and installed during construction of the floor, wall, ceiling, or roof. Round ducts larger than 375 mm (15 inches) in diameter and square, rectangular, and oval ducts passing through floors, walls, ceilings, or roof shall be installed through framed prepared openings. The Contractor shall be responsible for the proper size and location of sleeves and prepared openings. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Framed prepared openings shall be fabricated from 1.0 mm (20 gauge) galvanized steel, unless otherwise indicated. Where sleeves are installed in bearing walls or partitions, black steel pipe, ASTM A 53/A 53M, Schedule 20 shall be used. Sleeve shall provide 25 mm (1 inch) clearance between the duct and the sleeve or 25 mm (1 inch) clearance between the insulation and the sleeve for insulated ducts.

2.7.3.2 Framed Prepared Openings

Openings shall have 25 mm (1 inch) clearance between the duct and the opening or 25 mm (1 inch) clearance between the insulation and the opening for insulated ducts.

2.7.3.3 Closure Collars

Collars shall be fabricated of galvanized sheet metal not less than 100 mm (4 inches) wide, unless otherwise indicated, and shall be installed on exposed ducts on each side of walls or floors where sleeves or prepared openings are provided. Collars shall be installed tight against surfaces. Collars shall fit snugly around the duct or insulation. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier. Collars for round ducts 375 mm (15 inches) in diameter or less shall be fabricated from 1.0 mm (20 gauge) galvanized steel. Collars for round ducts larger than 375 mm (15 inches) and square, and rectangular ducts shall be fabricated from 1.3 mm (18 gauge) galvanized steel. Collars shall be installed with fasteners on maximum 150 mm (6 inch) centers, except that not less than 4 fasteners shall be used.

2.7.4 Sound Attenuation Equipment and Acoustical Duct Lining

Provide factory fabricated attenuators that will provide the DIL valves scheduled per the ASTM E-477-99 test standard. Maximum permissible pressure drop shall not exceed the scheduled values. Attenuators to be designed to be air-tight when operating under an internal pressure of , either from the factory, or after sealing by the contractor in the field. The air-side surface shall be capable of withstanding air velocities well above the project velocities. When attenuators are submitted for approval, provide manufacturer's certification of the sound reduction values. Provide suitable duct-transition sections for connection to ductwork. Submit full calculations on all silencers at project conditions.

Provide dissipative sound attenuators constructed of galvanized sheet steel (min. 22 gauge) casing and sound absorbing material covered with an internal perforated zinc-coated metal liner. Sound absorbing materials shall be held in compression to prevent settling. The internal perforated

metal liner shall be not less than 26 gage. Attenuators shall be insulated to prevent sweating. Attenuators shall be acoustically tested with metal duct inlet and outlet sections while under the rated air flow conditions. Noise reduction data shall include effects of flanking paths and vibration transmission.

Media shall be acoustic quality, shot-free glass fiber insulation with long, resilient fibers bonded with a thermosetting resin. Glass fiber density and compression shall be as required to insure conformance with laboratory test data. Glass fiber shall be packed with a minimum of 15% compression during silencer assembly. Media shall be bacteria and fungus resistant, resilient such that it will not crumble or break, and conforming to irregular surfaces. Media shall not cause or accelerate corrosion of aluminum or steel. Mineral wool will not be permitted as a substitute for glass fiber.

HTL Casings: Silencers shall have high transmission loss (HTL) walls externally applied and completely sealed to the silencer casing by the silencer manufacturer to assure quality controlled transmission loss. The HTL wall shall consist of media, airspace, mass and outer protective metal skin, as required, to obtain the specified room noise criteria. Standard acoustical panels will not be accepted as HTL walls. Breakout noise calculations shall be based on the sound power levels of the specified equipment.

Silencer dynamic insertion loss shall not be less than that listed in the silencer schedule.

Silencer dynamic noise shall not be less than that listed in the silencer schedule.

Acoustic performance shall include dynamic insertion loss and generated noise for forward flow (air and noise in same direction) or reverse flow (air and noise in opposite direction) in accordance with the project's air distribution system requirements.

All silencer ratings shall be determined in a duct-to-reverberant room test facility which provides for airflow in both directions through the test silencer in accordance with the ASTM E-477-99 test standard. The test set-up, procedure and facility shall eliminate all effects due to flanking, directivity, end reflection, standing waves and reverberation room absorption.

Silencer pressure drops shall not exceed those listed in the silencer schedule. Silencer pressure drop measurements shall be made in accordance with the ASTM E-477-99 test standard. Tests shall be conducted and reported on the identical units for which acoustical data is presented.

Acoustical duct lining shall be fibrous glass designed exclusively for lining ductwork and shall conform to the requirements of ASTM C 1071, Type I and II. Liner composition may be uniform density, graduated density, or dual density, as standard with the manufacturer. Lining shall be coated, not less than 25 mm (1 inch) thick. Where acoustical duct liner is used, liner or combination of liner and insulation applied to the exterior of the

ductwork shall be the thermal equivalent of the insulation specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS. Duct sizes shown shall be increased to compensate for the thickness of the lining used. In lieu of sheet metal duct with field-applied acoustical lining, acoustically equivalent lengths of fibrous glass duct or factory fabricated double-walled internally insulated duct with perforated liner may be provided. Net insertion loss value, static pressure drop, and air flow velocity capacity data shall be certified by a nationally recognized independent acoustical laboratory.

Equipment composite sound barrier to be thin, high performing, flexible, acoustical, composite blanket material with quilted faced fiberglass absorber on one or both sides, designed for when a noise source is on one side of the product. Product to meet project ASTM E 84 flame spread and smoke developed requirements. Product to be minimum 1.3 psf density, it is to be reinforced, and it is to be loaded with barium sulphate. Product to be rated in accordance to ASTM E413-87. Install per manufacturers recommendations without sagging, and to allow for convenient unit access.

2.7.5 Diffusers, Registers, and Grilles

Units shall be factory-fabricated of steel, corrosion-resistant steel, or aluminum and shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 0.25 m/s (50 fpm) in occupied zone, or dead spots anywhere in the conditioned area. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified according to ASHRAE 70. Inlets and outlets shall be sound rated and certified according to ASHRAE 70. Sound power level shall be as indicated. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Volume dampers shall be opposed blade type for all diffusers and registers, except linear slot diffusers. Linear slot diffusers shall be provided with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 2 m (7 feet) above the floor, they shall be protected by a grille or screen according to NFPA 90A. Lindab devices may be used.

2.7.5.1 Diffusers

Diffuser types shall be as indicated. Ceiling mounted units shall be furnished with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Diffusers shall be provided with air deflectors of the type indicated. Ceiling mounted units shall be installed with rims tight against ceiling. Sponge rubber gaskets shall be provided between ceiling and surface mounted diffusers for air leakage control. Suitable trim shall be provided for flush mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Return or exhaust units shall be similar to supply diffusers.

2.7.5.2 Registers and Grilles

Units shall be four-way directional-control type, except that return and

exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Wall supply registers shall be installed at least 150 mm (6 inches) below the ceiling unless otherwise indicated. Return and exhaust registers shall be located 150 mm (6 inches) above the floor unless otherwise indicated. Four-way directional control may be achieved by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

2.7.6 Arctic Hoods

Arctic hoods shall be fabricated from galvanized steel sheets with galvanized structural shapes. Sheet metal thickness, reinforcement, and fabrication shall conform to SMACNA HVAC Duct Const Stds. Louver blades shall be accurately fitted and secured to frames. Provide with bird screen. Refer to details on architectural drawings.

2.7.7 Bird Screens and Frames

Bird screens shall be No. 2 mesh, aluminum or stainless steel. Aluminum screens shall be rated "medium-light". Stainless steel screens shall be rated "light". Frames shall be removable type, or stainless steel or extruded aluminum.

2.8 AIR SYSTEMS EQUIPMENT

2.8.1 Fans

Fans shall be tested and rated according to AMCA 210. Fans may be connected to the motors either directly or indirectly with V-belt drive. V-belt drives shall be designed for not less than 150 percent of the connected driving capacity. Motor sheaves shall be variable pitch for 11 kW (15 hp) and below and fixed pitch as defined by ARI Guideline D. Variable pitch sheaves shall be selected to drive the fan at a speed which will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, a replaceable sheave shall be provided when needed to achieve system air balance. Motors for V-belt drives shall be provided with adjustable rails or bases. Removable metal guards shall be provided for all exposed V-belt drives, and speed-test openings shall be provided at the center of all rotating shafts. Fans shall be provided with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan.

Fan and motor assemblies shall be provided with vibration-isolation supports or mountings as indicated. Vibration-isolation units shall be standard products with published loading ratings. Each fan shall be selected to produce the capacity required at the fan static pressure indicated. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300. Standard AMCA arrangement, rotation, and discharge shall be as indicated.

2.8.1.1 In-Line Centrifugal Fans

In-line fans shall have centrifugal backward inclined blades, internal and external belt guards, and adjustable motor mounts. Fans shall be mounted in a square steel casing. Air shall enter and leave the fan axially. Inlets shall be streamlined to eliminate turbulence and provide smooth discharge air flow. Fan bearings and drive shafts shall be enclosed and isolated from the air stream. Fan bearings shall be sealed against dust and dirt and shall be permanently lubricated, and shall be precision self aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Motors shall have dripproof enclosure.

2.8.2 Coils Within Ventilation Units

Coils shall be fin-and-tube type constructed of seamless copper tubes and aluminum fins mechanically bonded or soldered to the tubes. Copper tube wall thickness shall be a minimum of 0.406 mm. Aluminum fins shall be 0.14 mm minimum thickness. Casing and tube support sheets shall be not lighter than 1.6 mm (16 gauge) galvanized steel, formed to provide structural strength. When required, multiple tube supports shall be provided to prevent tube sag. Each coil shall be tested at the factory under water at not less than 2.76 MPa air pressure and shall be suitable for 1.38 MPa working pressure. Coils shall be mounted for counterflow service. Coils shall be rated and certified according to ARI 410.

2.8.2.1 Water Coils

Water coils shall be installed with a pitch of not less than 10 mm per meter of the tube length toward the drain end. Headers shall be constructed of cast iron, welded steel or copper. Each coil shall be provided with a plugged vent and drain connection extending through the unit casing.

2.8.3 Air Filters Within Ventilation Units

Air filters shall be listed according to requirements of UL 900.

2.8.3.1 Extended Surface Nonsupported Pocket Filters

Filters shall be 750 mm depth, sectional, replaceable dry media type of the size indicated and shall have an average efficiency of 80 to 85 percent when tested according to ASHRAE 52.2. Initial resistance at 2.54 m/s shall not exceed 11 mm water gauge. Filters shall be UL Class 1. Media shall be fibrous glass, supported in the air stream by a wire or non-woven synthetic backing and secured to a galvanized steel metal header. Pockets shall not sag or flap at anticipated air flows. Each filter shall be installed with an extended surface pleated panel filter as a prefilter in a factory preassembled, side access housing or a factory-made sectional frame bank, as indicated.

2.8.3.2 Cartridge Type Filters

Filters shall be 305 mm depth, sectional, replaceable dry media type of

the size indicated and shall have an average efficiency of 80 to 85 percent when tested according to ASHRAE 52.2. Initial resistance at 2.54 m/s shall not exceed 14 mm, water gauge. Filters shall be UL class 1. Media shall be pleated microglass paper media with corrugated aluminum separators, sealed inside the filter cell to form a totally rigid filter assembly. Fluctuations in filter face velocity or turbulent airflow will have no effect on filter integrity or performance. Each filter shall be installed with an extended surface pleated media panel filter as a prefilter in a factory preassembled side access housing, or a factory-made sectional frame bank, as indicated.

2.9 HEAT RECOVERY/VENTILATION UNITS

2.9.1 Factory-Fabricated Units

Casing to be a modular frame style clad with double wall, insulated panels.

Panels to be constructed of minimum 50 mm thick galvanized steel and sandwiched insulation to be mineral wool. Frame is to be assembled by means of insertion edges and interior of unit is to be smooth to facilitate easy cleaning. Casing leakage to be minimum. Panels to be easily removable and are to be gasketed. Access doors to have tongue locks operated with either 8 mm square keys or handles. Doors to open 180 degrees. Components inside the units to be mounted on rails ensuring easy removal for service and maintenance. Unit joints to be secured via internal bolts.

Units to be finished with a coat of aluzine meeting Danish requirements for operation in unheated, low corrosion environments in accordance with DS/EN ISO 12994-2, corrosion Category 2.

Wet sections of units are to be fitted with drip pans in corrosion-proof material with drains out through the access side. Drains to be fitted with water traps.

Units to be mounted on base rails.

Air filters to meet EN 776 and ASHRAE 52-76 and are to be of the pocket variety.

Preheat and post heat coils are to be constructed of copper tubes and aluminum fins and the coils are to be mounted in sheet steel frames. Coils are to be provided with drains and vents and they are to be installed in rails for easy removal.

The cross flow, plate type heat exchanger to be constructed of aluminum with separated airstreams, stainless steel drain pans, drain connection, and integral bypass with regulation damper.

Unit fans to be belt driven, double-width, double inlet centrifugals, or direct drive, axial flow type, per equipment schedules. Fans to be isolated from unit cabinet. Provide variable frequency drives for unit exhaust fans with manual bypasses, disconnects, input line reactors, and interfaces compatible with DDC control system.

Coils and filters for these units further specified elsewhere in this section.

Units to be York-Novenco ZCN, or equal.

2.10 FACTORY PAINTING

Units which are not of galvanized construction according to ASTM A 123/A 123M or ASTM A 924/A 924M shall be factory painted with a corrosion resisting paint finish. Internal and external ferrous metal surfaces shall be cleaned, phosphatized and coated with a paint finish which has been tested according to ASTM B 117, ASTM D 1654, and ASTM D 3359. Evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors shall be submitted. Rating of failure at the scribe mark shall be not less than 6, average creepage not greater than 3 mm.. Rating of the inscribed area shall not be less than 10, no failure. On units constructed of galvanized steel which have been welded, exterior surfaces of welds or welds that have burned through from the interior shall receive a final shop docket of zinc-rich protective paint according to ASTM D 520 Type I.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

3.1.1 Penetrations

3.1.1.1 Ducts

Provide sleeves and prepared openings for duct mains, branches, and other item penetrations, and install during the construction of the surface to be penetrated. Cut sleeves flush with each surface; sleeves for round duct shall be 380 mm and smaller; provide framed prepared openings for round duct larger than 380 mm (15 inches) and square, rectangular or oval ducts. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Provide 25 mm (1 inch) clearance between penetrating and penetrated surfaces except at grilles, registers, and diffusers. Pack spaces between sleeve or opening and duct or duct insulation with mineral fiber conforming to ASTM C 553, Type 1, Class B-2.

a. Sleeve Fabrication: Fabricate sleeves, except as otherwise specified or indicated, from 20 gauge 1 mm (0.0396 inch) thick minimum galvanized steel sheet. Where sleeves are installed in bearing walls or partitions, provide black steel pipe conforming to ASTM A 53/A 53M, Schedule 40.

b. Framed Prepared Openings: Fabricate framed prepared openings from 1 mm (0.0396 inch) minimum galvanized steel sheet, unless otherwise indicated. Reinforce all around openings with 25 x 25 x 3 mm (1 x 1 x 0.125 inch) galvanized steel angles, tack welded to wall side of openings; angle leg shall be flush with ends of opening.

c. Closure Collars: Provide closure collars of a minimum 100 mm (4 inches) width, unless otherwise indicated, for exposed ducts and items on each side of penetrated surface, except where equipment is installed. Install collar tight against the surface and fit snugly around the duct or insulation. Grind sharp edges smooth to prevent damage to penetrating surface. Fabricate collars for round ducts 380 mm (15 inches) in diameter or less from 1 mm (0.0396) minimum galvanized steel. Fabricate collars for square and rectangular ducts, or round ducts with a minimum dimension over 380 mm (15 inches) from 1.4 mm (0.0516 inch) galvanized steel. Fabricate collars for square and rectangular ducts with a maximum side of 380 mm (15 inches) or less from 1 mm (0.0396 inches) galvanized steel. Install collars with fasteners a maximum of 150 mm (6 inches) on centers; attach to collars a minimum of 4 fasteners where opening is 300 mm (12 inches) in diameter or less, and a minimum of 8 fasteners where the opening is 500 mm (20 inches) in diameter or less.

3.1.1.2 Packing and Sealant

Pack the space between the pipe or tubing and the sleeve firmly with mineral wool insulation. Except as otherwise specified, the annular space at both ends of the sleeve shall be sealed as indicated with sealants conforming to ASTM C 920 and with primer, backstop material and surface preparation as specified in Section 07920 JOINT SEALANTS. The annular space shall not be sealed for interior walls and chase walls that are not designated as fire rated or requiring acoustical attenuation. In waterproofed construction, caulk both ends of the sleeve with plastic waterproof cement that will dry to a firm but pliable mass. In lieu of plastic waterproof cement and mineral wool insulation, a mechanically adjustable, segmented, elastomeric seal may be used; if used, seal segments shall be interlocking and shaped to continuously fill the annular space between the pipe and sleeve to provide a watertight seal when expanded by tightening fasteners. Fasteners shall be galvanized. Where sleeves are installed in below-grade walls in contact with earth, fill the annular space between pipe and sleeve with backing material and sealants in the joint between the pipe and concrete or masonry. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Where pipes pass through fire-rated walls, fire-partitions, fire-rated chase walls or floors above grade, the penetration shall be sealed with firestopping materials as specified in Section 07840 FIRESTOPPING.

3.1.1.3 Fire Seal

Where pipes pass through rated entities, firewalls, fire partitions, or floors, a fire seal shall be provided as specified in Section 07840 FIRESTOPPING.

3.1.1.4 Escutcheons

Escutcheons shall be provided at finished surfaces where exposed piping, bare or insulated, passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms. Where sleeves project slightly from

floors, special deep-type escutcheons shall be used. Escutcheons shall be secured to pipe or pipe covering. Escutcheons shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.1.1.5 Electrical Penetrations

Seal openings around electrical penetrations through fire-rated walls, partitions, floors, or ceilings in accordance with Section 07840 FIRESTOPPING. Provide flanges where busways make penetrations through walls and floors, and seal to maintain smoke and fire ratings. Where conductors run through smoke and fire partitions, install in 103 mm (4 inches) rigid steel conduits with grounding bushings, extending 305 mm (12 inches) beyond each side of partitions. Seal conduit on both ends to maintain smoke and fire ratings of partitions.

3.1.1.2 Condensate Drain Lines

Water seals shall be provided in the condensate drain from all ventilation units. The depth of each seal shall be 50 mm (2 inches) plus 0.1 mm for each Pa, of the total static pressure rating of the unit to which the drain is connected. Water seals shall be constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Pipe cap or plug cleanouts shall be provided where indicated. Drains indicated to connect to the sanitary waste system shall be connected by an indirect waste fitting. Air conditioner drain lines shall be insulated as specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.1.1.3 Equipment and Installation

Frames and supports shall be provided for ventilation units, fans, dampers, and other similar items requiring supports. Ventilation units shall be floor mounted or ceiling hung, as indicated. The method of anchoring and fastening shall be as detailed. Floor-mounted equipment, unless otherwise indicated, shall be set on not less than 150 mm (6 inch) pads or curbs secured in place.

3.1.1.4 Access Panels

Access panels shall be provided for concealed controls, dampers, and items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Access panels shall be as specified in Section 05500A MISCELLANEOUS METALS.

3.1.1.5 Flexible Connectors

Pre-insulated flexible connectors and flexible duct shall be attached to other components in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the connector or duct manufacturer and shall be provided at the intervals recommended.

3.1.6 Sleeved and Framed Openings

Space between the sleeved or framed opening and the duct or the duct insulation shall be packed as specified in Section 07840 FIRESTOPPING for fire rated penetrations. For non-fire rated penetrations, the space shall be packed as specified in Section 07920 JOINT SEALANTS.

3.1.7 Metal Ductwork

Installation shall be according to SMACNA HVAC Duct Const Stds unless otherwise indicated. Duct supports for sheet metal ductwork shall be according to SMACNA HVAC Duct Const Stds, unless otherwise specified. Friction beam clamps indicated in SMACNA HVAC Duct Const Stds shall not be used. Risers on high velocity ducts shall be anchored in the center of the vertical run to allow ends of riser to move due to thermal expansion. Supports on the risers shall allow free vertical movement of the duct. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.

3.1.8 Acoustical Duct Lining

Lining shall be applied in cut-to-size pieces attached to the interior of the duct with nonflammable fire resistant adhesive conforming to ASTM C 916, Type I, NFPA 90A, UL 723, and ASTM E 84. Top and bottom pieces shall lap the side pieces and shall be secured with welded pins, adhered clips of metal, nylon, or high impact plastic, and speed washers or welding cup-head pins installed according to SMACNA HVAC Duct Const Stds. Welded pins, cup-head pins, or adhered clips shall not distort the duct, burn through, nor mar the finish or the surface of the duct. Pins and washers shall be flush with the surfaces of the duct liner and all breaks and punctures of the duct liner coating shall be sealed with the nonflammable, fire resistant adhesive. Exposed edges of the liner at the duct ends and at other joints where the lining will be subject to erosion shall be coated with a heavy brush coat of the nonflammable, fire resistant adhesive, to prevent delamination of glass fibers. Duct liner may be applied to flat sheet metal prior to forming duct through the sheet metal brake. Lining at the top and bottom surfaces of the duct shall be additionally secured by welded pins or adhered clips as specified for cut-to-size pieces. Other methods indicated in SMACNA HVAC Duct Const Stds to obtain proper installation of duct liners in sheet metal ducts, including adhesives and fasteners, will be acceptable.

3.1.9 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, temporary dust control protection shall be provided. The distribution system (supply and return) shall be protected with temporary seal-offs at all inlets and outlets at the end of each day's work. Temporary protection shall remain in place until system is ready for startup.

3.1.10 Insulation

Thickness and application of insulation materials for ductwork, piping, and equipment shall be according to Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS. Outdoor air intake ducts and plenums shall be externally insulated up to the point where the outdoor air reaches the conditioning unit.

3.1.11 Duct Test Holes

Holes with closures or threaded holes with plugs shall be provided in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Extensions, complete with cap or plug, shall be provided where the ducts are insulated.

3.1.12 Power Transmission Components Adjustment

V-belts and sheaves shall be tested for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Belts on drive side shall be uniformly loaded, not bouncing. Alignment of direct driven couplings shall be to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.2 FIELD PAINTING AND IDENTIFICATION SYSTEMS

3.2.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and item number shall be installed on all valves and dampers. Tags shall be 35 mm minimum diameter and marking shall be stamped or engraved. Indentations shall be black for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.

3.2.2 Finish Painting and Pipe Color Code Marking

Finish painting of items only primed at the factory, surfaces not specifically noted otherwise, and color code marking for piping shall be as specified in Section 09900 PAINTS AND COATINGS.

3.2.3 Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of components and equipment that are not visible from the finished space and are accessible from the ceiling grid. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 12 mm (3/8 inch) diameter and secured to removable ceiling panels with fasteners. Each fastener shall be inserted into the ceiling panel so as to be concealed from view. The fasteners shall be manually removable without the use of tools and shall not separate from the ceiling panels when the panels are dropped from ceiling height. Installation of colored metal disks shall follow

completion of the finished surface on which the disks are to be fastened. The color code board shall be approximately 1 m (3 foot) wide, 750 mm (30 inches) high, and 12 mm (1/2 inches) thick. The board shall be made of wood fiberboard and framed under glass or 1.6 mm (1/6 inches) transparent plastic cover. The color code symbols shall be approximately 20 mm (3/4 inches) in diameter and the related lettering in 12 mm (1/2 inch) high capital letters. The color code board shall be mounted in the mechanical or equipment room. The color code system shall be as determined by base personnel

3.3 DUCTWORK LEAK TEST

Ductwork leak test shall be performed for the entire air distribution and exhaust system. Test procedure, apparatus, and report shall conform to SMACNA Leakage Test Mnl. The maximum allowable leakage rate is 2 percent of system flow. Ductwork leak test shall be completed with satisfactory results prior to applying insulation to ductwork exterior.

3.4 DAMPER ACCEPTANCE TEST

All fire dampers shall be operated under normal operating conditions, prior to the occupancy of a building to determine that they function properly. Fire dampers equipped with fusible links shall be tested by having the fusible link cut in place. Dynamic fire dampers shall be tested with the air handling and distribution system running. All fire dampers shall be reset with the fusible links replaced after acceptance testing. To ensure optimum operation and performance, the damper must be installed so it is square and free from racking.

3.5 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting, and balancing shall be as specified in Section 15990A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS. Testing, adjusting, and balancing shall begin only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.6 PERFORMANCE TESTS

After testing, adjusting, and balancing has been completed as specified, each system shall be tested as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Corrections and adjustments shall be made as necessary to produce the conditions indicated or specified. Capacity tests and general operating tests shall be conducted by an experienced engineer. Tests shall cover a period of not less than 2 days for each system and shall demonstrate that the entire system is functioning according to the specifications. Coincidental chart recordings shall be made at points indicated on the drawings for the duration of the time period and shall record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

3.7 CLEANING AND ADJUSTING

Insides of ventilation units and ducts shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided prior to startup of all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.8 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 8 hours of normal working time and shall start after the system is functionally complete but prior to the performance tests. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

SECTION 15951A

DIRECT DIGITAL CONTROL FOR HVAC
11/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D (1998) Laboratory Methods of Testing
Dampers for Rating

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1 (2001) Electric Meters Code for
Electricity Metering

ASME INTERNATIONAL (ASME)

ASME B40.100 (2000) Pressure Gauges and Gauge
Attachments

ASTM INTERNATIONAL (ASTM)

ASTM A 269 (2002a) Seamless and Welded Austenitic
Stainless Steel Tubing for General Service

ASTM B 88 (2002) Seamless Copper Water Tube

ASTM B 88M (1999) Seamless Copper Water Tube (Metric)

ASTM D 1693 (2001) Environmental Stress-Cracking of
Ethylene Plastics

ASTM D 635 (2003) Rate of Burning and/or Extent and
Time of Burning of Plastics in a
Horizontal Position

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/EIA/TIA-232-F (2002) Interface Between Data Terminal
Equipment and Data Circuit-Terminating
Equipment Employing Serial Binary Data
Interchange

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991) Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits
IEEE Std 142	(1992) Recommended Practice for Grounding of Industrial and Commercial Power Systems - Green Book

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1997) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(2000) Industrial Control and Systems: General Requirements
NEMA ST 1	(1988; R 1994; R 1997) Specialty Transformers (Except General Purpose Type)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code
NFPA 90A	(2002) Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 268A	(1998; Rev thru Apr 2003) Smoke Detectors for Duct Application
UL 508	(1999; Rev thru Dec 2002) Industrial Control Equipment
UL 94	(1996; Rev thru May 2001) Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

1.2 GENERAL REQUIREMENTS

The direct digital control (DDC) shall be a complete system suitable for the heating, ventilating and air-conditioning (HVAC) system.

1.2.1 Nameplates, Lens Caps, and Tags

Nameplates and lens caps bearing legends as shown and tags bearing device-unique identifiers as shown shall have engraved or stamped characters. A plastic or metal tag shall be mechanically attached directly to each device or attached by a metal chain or wire. Each airflow measurement station shall have a tag showing flow rate range for signal output range, duct size, and identifier as shown.

1.2.2 Verification of Dimensions

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

1.2.3 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, shall arrange such work accordingly, and shall furnish all work necessary to meet such conditions.

1.2.4 Power-Line Surge Protection

Equipment connected to ac circuits shall be protected from power-line surges. Equipment protection shall meet the requirements of IEEE C62.41. Fuses shall not be used for surge protection.

1.2.5 Surge Protection for Transmitter and Control Wiring

DDC system control-panel equipment shall be protected against surges induced on control and transmitter wiring installed outside and as shown. The equipment protection shall be tested in the normal mode and in the common mode, using the following two waveforms:

- a. A 10-microsecond by 1,000-microsecond waveform with a peak voltage of 1,500 volts and a peak current of 60 amperes.
- b. An eight microsecond by 20-microsecond waveform with a peak voltage of 1,000 volts and a peak current of 500 amperes.

1.2.6 System Overall Reliability Requirement

The system shall be configured and installed to yield a mean time between failure (MTBF) of at least 40,000 hours. Each DDC controller shall be designed, configured, installed and programmed to provide for stand alone operation with minimal performance degradation on failure of other system components to which it is connected or with which it communicates.

1.2.7 DDC System Network Accessibility

Where the systems to be controlled by the DDC system are located in multiple mechanical rooms, each mechanical room shall have at least one communication port for the portable workstation/tester. DDC controllers shall be located in the same room as the equipment being controlled or in an adjacent space which has direct access to the equipment room.

1.2.8 System Accuracy and Display

The system shall maintain an end-to-end accuracy for one year from sensor to operator's console display for the applications specified and shall

display the value as specified. Each temperature shall be displayed and printed to nearest 0.05 degree C .

1.2.8.1 Space Temperature

Space temperature with a range of 10 to 30 degrees C plus or minus 0.5 degrees C for conditioned space; minus 1 to plus 55 degrees C plus or minus 0.5 degrees C for unconditioned space.

1.2.8.2 Duct Temperature

Duct temperature with a range of 5 to 60 degrees C plus or minus 1 degree C .

1.2.8.3 Outside Air Temperature

Outside air (OA) temperature with a range of minus 35 to plus 55 degrees C plus or minus 1 degree C ; with a subrange of minus 1 to plus 40 degrees C plus or minus 0.5 degree C .

1.2.8.4 Water Temperature

Water temperature with a range of minus 1 to plus 40 degrees C plus or minus 0.5 degree C ; the range of 40 to 120 degrees C plus or minus 1 degree C ; and water temperatures for the purpose of performing energy calculations using differential temperatures to plus or minus 0.5 degree C using matched sensors.

1.2.8.5 Relative Humidity

Relative humidity, within a range of 20 to 80 percent, plus or minus 6.0 percent of range (display and print to nearest 1.0 percent).

1.2.8.6 Pressure

Pressure with a range for the specific application plus or minus 2.0 percent of range (display and print to nearest kPa).

1.2.8.7 Flow

Flow with a range for the specific application plus or minus 3.0 percent of range, and flows for the purpose of thermal calculations to plus or minus 2.0 percent of actual flow (display and print to nearest unit, such as L/second .

1.2.8.8 KWh and kW Demand

KWh and kW demand with a range for the specific application plus or minus 1.0 percent of reading (display and print to nearest kWh or kW).

1.2.8.9 Analog Value Input

An analog value input to the system's equipment via an AI with a maximum error of 0.50 percent of range, not including the sensor or transmitter

error. This accuracy shall be maintained over the specified environmental conditions.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

HVAC Control System; G

Drawings shall be on A1 (841 by 594 mm) sheets in the form and arrangement shown. The drawings shall use the same abbreviations, symbols, nomenclature and identifiers shown. Each control system element on a drawing shall have a unique identifier as shown. The HVAC Control System Drawings shall be delivered together as a complete submittal. Deviations must be approved by the Contracting Officer. Drawings shall be submitted along with Submittal SD-03 Product Data.

a. HVAC Control System Drawings shall include the following:

Sheet One: Drawing Index, HVAC Control System Legend.
Sheet Two: Valve Schedule, Damper Schedule.
Sheet Three: Not Used.
Sheet Four: Control System Schematic and Equipment Schedule.
Sheet Five: Sequence of Operation and Data Terminal Strip

Layout.

Sheet Six: Control Loop Wiring Diagrams.
Sheet Seven: Motor Starter and Relay Wiring Diagram.
Sheet Eight: Communication Network and Block Diagram.
Sheet Nine: DDC Panel Installation and Block Diagram.

(Repeat Sheets Four through Seven for each AHU System.)

b. The HVAC Control System Drawing Index shall show the name and number of the building, military site, State or other similar designation, and Country. The Drawing Index shall list HVAC Control System Drawings, including the drawing number, sheet number, drawing title, and computer filename when used. The HVAC Control System Legend shall show generic symbols and the name of devices shown on the HVAC Control System Drawings.

c. The valve schedule shall include each valve's unique identifier, size, flow coefficient Kv, pressure drop at specified flow rate, spring range, positive positioner range, actuator size, close-off pressure data, dimensions, and access and clearance requirements data. Valve schedules may be submitted in advance but shall be included in the complete submittal.

d. The damper schedule shall contain each damper's and each actuator's identifier, nominal and actual sizes, orientation of axis and frame, direction of blade rotation, spring ranges, operation rate, positive positioner ranges, locations of actuators and damper end switches, arrangement of sections in multi-section dampers, and methods of connecting dampers, actuators, and linkages. The Damper Schedule shall include the maximum leakage rate at the operating static-pressure differential. The Damper Schedule shall contain actuator selection data supported by calculations of the torque required to move and seal the dampers, access and clearance requirements. Damper schedules may be submitted in advance but shall be included in the complete submittal.

e. The HVAC control system schematics shall be in the form shown, and shall show all control and mechanical devices associated with the HVAC system. A system schematic drawing shall be submitted for each HVAC system.

f. The HVAC control system equipment Schedule shall be in the form shown. All devices shown on the drawings having unique identifiers shall be referenced in the equipment schedule. Information to be included in the equipment schedule shall be the control loop, device unique identifier, device function, setpoint, input range, and additional important parameters (i.e., output range). An equipment schedule shall be submitted for each HVAC system.

g. The HVAC control system sequence of operation shall reflect the language and format of this specification, and shall refer to the devices by their unique identifiers as shown. No operational deviations from specified sequences will be permitted without prior written approval of the Contracting Officer. Sequences of operation shall be submitted for each HVAC control system including each type of terminal unit control system.

h. The HVAC control system wiring diagrams shall be functional wiring diagrams which show the interconnection of conductors and cables to HVAC control panel terminal blocks and to the identified terminals of devices, starters and package equipment. The wiring diagrams shall show necessary jumpers and ground connections. The wiring diagrams shall show the labels of all conductors. Sources of power required for HVAC control systems and for packaged equipment control systems shall be identified back to the panel board circuit breaker number, HVAC system control panel, magnetic starter, or packaged equipment control circuit. Each power supply and transformer not integral to a controller, starter, or packaged equipment shall be shown. The connected volt-ampere load and the power supply volt-ampere rating shall be shown. Wiring diagrams shall be submitted for each HVAC control system.

SD-03 Product Data

Service Organizations

Six copies of a list of service organizations qualified to service the HVAC control system. The list shall include the service organization name, address, technical point of contact and telephone number, and contractual point of contact and telephone number.

Equipment Compliance Booklet

The HVAC Control System Equipment Compliance Booklet (ECB) shall be in booklet form and indexed, with numbered tabs separating the information on each device. It shall consist of, but not be limited to, data sheets and catalog cuts which document compliance of all devices and components with the specifications. The ECB shall be indexed in alphabetical order by the unique identifiers. Devices and components which do not have unique identifiers shall follow the devices and components with unique identifiers and shall be indexed in alphabetical order according to their functional name. The ECB shall include a Bill of Materials for each HVAC Control System. The Bill of Materials shall function as the Table of Contents for the ECB and shall include the device's unique identifier, device function, manufacturer, model/part/catalog number used for ordering, and tab number where the device information is located in the ECB. The ECB shall be submitted along with Submittal SD-02 Shop Drawings.

Commissioning Procedures

Six copies of the HVAC control system commissioning procedures, in booklet form and indexed, 60 days prior to the scheduled start of commissioning. Commissioning procedures shall be provided for each HVAC control system, and for each type of terminal unit control system. The Commissioning procedures shall reflect the format and language of this specification, and refer to devices by their unique identifiers as shown. The Commissioning procedures shall be specific for each HVAC system, and shall give detailed step-by-step procedures for commissioning of the system.

a. The Commissioning procedures shall include detailed, product specific set-up procedures, configuration procedures, adjustment procedures, and calibration procedures for each device. Where the detailed product specific commissioning procedures are included in manufacturer supplied manuals, reference may be made in the HVAC control system commissioning procedures to the manuals.

b. An HVAC control system commissioning procedures equipment list shall be included that lists the equipment to be used to accomplish commissioning. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

Performance Verification Test Procedures

Six copies of the HVAC Control System Performance Verification

Test Procedures, in booklet form and indexed, 60 days before the Contractor's scheduled test dates. The performance verification test procedures shall refer to the devices by their unique identifiers as shown, shall explain, step-by-step, the actions and expected results that will demonstrate that the HVAC control system performs in accordance with the sequences of operation, and other contract documents. An HVAC control system performance verification test equipment list shall be included that lists the equipment to be used during performance verification testing. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

Training; G

An outline for the HVAC control system training course with a proposed time schedule. Approval of the planned training schedule shall be obtained from the Government at least 60 days prior to the start of the training. Six copies of HVAC control system training course material 30 days prior to the scheduled start of the training course. The training course material shall include the operation manual, maintenance and repair manual, and paper copies of overheads used in the course.

SD-06 Test Reports

Commissioning Report

Six copies of the HVAC Control System Commissioning Report, in booklet form and indexed, within 30 days after completion of the system commissioning. The commissioning report shall include data collected during the HVAC control system commissioning procedures and shall follow the format of the commissioning procedures. The commissioning report shall include all configuration checksheets with final values listed for all parameters, setpoints, P, I, D setting constants, calibration data for all devices, results of adjustments, and results of testing.

Performance Verification Test; G

Six copies of the HVAC Control System Performance Verification Test Report, in booklet form and indexed, within 30 days after completion of the test. The HVAC control system performance verification test report shall include data collected during the HVAC control system performance verification test. The original copies of all data gathered during the performance verification test shall be turned over to the Government after Government approval of the test results.

SD-10 Operation and Maintenance Data

Operation Manual

Maintenance and Repair Manual

Six copies of the HVAC Control System Operation Manual , for each HVAC control system, 30 days before the date scheduled for the training course.

1.4 DELIVERY AND STORAGE

Products shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants, within the storage condition limits published by the equipment manufacturer. Dampers shall be stored so that seal integrity, blade alignment and frame alignment are maintained.

1.5 OPERATION MANUAL

An HVAC control system operation manual in indexed booklet form shall be provided for each HVAC control system. The operation manual shall include the HVAC control system sequence of operation, and procedures for the HVAC system start-up, operation and shut-down. The operation manual shall include as-built HVAC control system detail drawings. The operation manual shall include the as-built configuration checksheets, the procedures for changing HVAC control system setpoints, and the procedures for placing HVAC system controllers in the manual control mode.

- a. The procedures for changing HVAC control system setpoints shall describe the step-by-step procedures required to change the process variable setpoints, the alarm setpoints, the bias settings, and setpoint reset schedules.
- b. The procedures for placing HVAC system controllers in the manual control mode shall describe step-by-step procedures required to obtain manual control of each controlled device and to manually adjust their positions.

1.6 MAINTENANCE AND REPAIR MANUAL

An HVAC control system maintenance and repair manual in indexed booklet form in hardback binders shall be provided for each HVAC control system. The maintenance and repair manual shall include the routine maintenance checklist, a recommended repair methods list, a list of recommended maintenance and repair tools, the qualified service organization list, the as-built commissioning procedures and report, the as-built performance verification test procedures and report, and the as-built equipment data booklet.

- a. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list all devices listed in the equipment compliance booklet, the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.
- b. The recommended repair methods list shall be arranged in a columnar format and shall list all devices in the equipment data

compliance booklet and state the guidance on recommended repair methods, either field repair, factory repair, or whole-item replacement.

c. The as-built equipment data booklet shall include the equipment compliance booklet and manufacturer supplied user manuals and information.

d. If the operation manual and the maintenance and repair manual are provided in a common volume, they shall be clearly differentiated and separately indexed.

1.7 MAINTENANCE AND SERVICE

Services, materials and equipment shall be provided as necessary to maintain the entire system in an operational state as specified for a period of one year after successful completion and acceptance of the Performance Verification Test. Impacts on facility operations shall be minimized.

1.7.1 Description of Work

The adjustment and repair of the system shall include the manufacturer's required adjustments of computer equipment, software updates, transmission equipment and instrumentation and control devices.

1.7.2 Personnel

Service personnel shall be qualified to accomplish work promptly and satisfactorily. The Government shall be advised in writing of the name of the designated service representative, and of any changes in personnel. The Contractor shall submit a list of Service Organizations as specified in the Submittals paragraph.

1.7.3 Scheduled Inspections

Two inspections shall be performed at six-month intervals and all work required shall be performed. Inspections shall be scheduled in June and December . These inspections shall include:

- a. Visual checks and operational tests of equipment.
- b. Fan checks and filter changes for control system equipment.
- c. Clean control system equipment including interior and exterior surfaces.
- d. Check and calibrate each field device. Check and calibrate 50 percent of the total analog points during the first inspection. Check and calibrate the remaining 50 percent of the analog points during the second major inspection. Certify analog test instrumentation accuracy to be twice that of the device being calibrated. Randomly check at least 25 percent of all digital points for proper operation during the first inspection. Randomly

check at least 25 percent of the remaining digital points during the second inspection.

e. Run system software diagnostics and correct diagnosed problems.

f. Resolve any previous outstanding problems.

1.7.4 Scheduled Work

This work shall be performed during regular working hours, Monday through Friday, excluding legal holidays.

1.7.5 Emergency Service

The Government will initiate service calls when the system is not functioning properly. Qualified personnel shall be available to provide service to the system. A telephone number where the service supervisor can be reached at all times shall be provided. Service personnel shall be at the site within 24 hours after receiving a request for service. The control system shall be restored to proper operating condition within three calendar days after receiving a request for service.

1.7.6 Operation

Scheduled adjustments and repairs shall include verification of the control system operation as demonstrated by the applicable tests of the performance verification test.

1.7.7 Records and Logs

Dated records and logs shall be kept of each task, with cumulative records for each major component, and for the complete system chronologically. A continuous log shall be maintained for all devices. The log shall contain initial analog span and zero calibration values and digital points. Complete logs shall be kept and shall be available for inspection onsite, demonstrating that planned and systematic adjustments and repairs have been accomplished for the control system.

1.7.8 Work Requests

Each service call request shall be recorded as received and shall include the serial number identifying the component involved, its location, date and time the call was received, nature of trouble, names of the service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials to be used, the time and date work started, and the time and date of completion. A record of the work performed shall be submitted within 5 days after work is accomplished.

1.7.9 System Modifications

Recommendations for system modification shall be submitted in writing. No system modifications, including operating parameters and control settings, shall be made without prior approval of the Government. Any modifications made to the system shall be incorporated into the operations and

maintenance manuals, and other documentation affected.

1.7.10 Software

Updates to the software shall be provided for system, operating and application software, and operation in the system shall be verified. Updates shall be incorporated into operations and maintenance manuals, and software documentation. There shall be at least one scheduled update near the end of the first year's warranty period, at which time the latest released version of the Contractor's software shall be installed and validated.

1.8 FACTORY TESTING

The Contractor shall assemble the factory test DDC system as specified and shall perform test to demonstrate that the performance of the system satisfies the requirements of this specification. Model numbers of equipment tested shall be identical to those to be delivered to the site. Original copies of data produced, including results of each test procedure during factory testing shall be delivered to the Government at the conclusion of testing, prior to Government approval of the test. The test results documentation shall be arranged so that commands, responses, and data acquired are correlated in a manner which will allow for logical interpretation of the data.

1.8.1 Factory Test Setup

The factory test setup shall include the following:

- a. Central workstation/tester.
- b. Printer.
- c. DDC test set.
- d. Portable workstation/tester.
- e. Communication links of each type and speed including MODEMs.
- f. Dial-up MODEM.
- g. Software.

PART 2 PRODUCTS

2.1 GENERAL EQUIPMENT REQUIREMENTS

Units of the same type of equipment shall be products of a single manufacturer. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place. Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in a satisfactory commercial or industrial use for two years prior to use on this project. The two years' use shall include applications of equipment and materials under similar circumstances and of similar size. The two years' experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a two-year field service record will be

acceptable if a certified record of satisfactory field operation, for not less than 6,000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization. Items of the same type and purpose shall be identical, including equipment, assemblies, parts and components. Automatic temperature controls shall be direct digital controls that will provide the required sequence of operation. DDC system manufactures to be Invensys, Trend (part of Novar Group), or t.a.c (headquartered in Malmo, Sweden).

2.1.1 Electrical and Electronic Devices

Electrical, electronic, and electropneumatic devices not located within a DDC panel shall have a NEMA ICS 1 enclosure in accordance with NEMA 250 unless otherwise shown.

2.1.2 Standard Signals

Except for air distribution terminal unit control equipment, the output of all analog transmitters and the analog input and output of all DDC controllers shall be 4-to-20 mA_{dc} signals. The signal shall originate from current-sourcing devices and shall be received by current-sinking devices.

2.1.3 Ambient Temperature Limits

DDC panels shall have ambient condition ratings of 1.7 to 49 degrees C and 10 to 95 percent relative humidity, noncondensing. Devices installed outdoors shall operate within limit ratings of minus 37 to plus 66 degrees C. Instrumentation and control elements shall be rated for continuous operation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified or normally encountered for the installed location.

2.2 TUBING

2.2.1 Copper

Copper tubing shall conform to ASTM B 88, ASTM B 88M and shall have sweat fittings and valves.

2.2.2 Stainless Steel

Stainless steel tubing shall conform to ASTM A 269 and shall have stainless steel compression fittings.

2.2.3 Plastic

Plastic tubing shall have barbed fittings and valves. Plastic tubing shall have the burning characteristics of linear low-density polyethylene tubing, shall be self-extinguishing when tested in accordance with ASTM D 635, shall have UL 94 V-2 flammability classification, and shall withstand stress cracking when tested in accordance with ASTM D 1693. Plastic-tubing bundles shall be provided with Mylar barrier and flame-retardant polyethylene jacket.

2.3 WIRING

2.3.1 Terminal Blocks

Terminal blocks shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, shall be suitable for rail mounting, and shall have end plates and partition plates for separation or shall have enclosed sides.

2.3.2 Control Wiring for 24-Volt Circuits

Control wiring for 24-volt circuits shall be 18 AWG minimum, stranded copper and shall be rated for 300-volt service.

2.3.3 Wiring for 120-Volt Circuits

Wiring for 120-volt circuits shall be 18 AWG minimum, stranded copper and shall be rated for 600-volt service.

2.3.4 Instrumentation Cable

Instrumentation cable shall be 18 AWG, stranded copper, single- or multiple-twisted, minimum 50 mm lay of twist, 100 percent shielded pairs, and shall have a 300-volt insulation. Each pair shall have a 20 AWG tinned-copper drain wire and individual overall pair insulation. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape, overall 20 AWG tinned-copper cable drain wire, and overall cable insulation.

2.3.5 Transformers

Step down transformers shall be utilized where control equipment operates at lower than line circuit voltage. Transformers, other than transformers in bridge circuits, shall have primaries wound for the voltage available and secondaries wound for the correct control circuit voltage. Transformer shall be sized so that the connected load is 80 percent of the rated capacity or less. Transformers shall conform to UL 508 and NEMA ST 1.

2.4 ACTUATORS

Actuators shall be electric or electronic as shown and shall be provided with mounting and connecting hardware. Actuators shall fail to their spring-return positions on signal or power failure. The actuator stroke shall be limited in the direction of power stroke by an adjustable stop. Actuators shall have a visible position indicator. Actuators shall smoothly open or close the devices to which they are applied and shall have a full stroke response time of 90 seconds or less. Electric actuators shall have an oil-immersed gear train. Electric or electronic actuators operating in series shall have an auxiliary actuator driver. Electric or electronic actuators used in sequencing applications shall have an adjustable operating range and start point.

2.4.1 Valve Actuators

Valve actuators shall be selected to provide a minimum of 125 percent of the motive power necessary to operate the valve over its full range of operation.

2.5 AUTOMATIC CONTROL VALVES

Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Unless otherwise stated, valves shall have globe style bodies. Valve bodies shall be designed for not less than 862 kPa working pressure or 150 percent of the system operating pressure, whichever is greater. Valve leakage rating shall be 0.01 percent of rated Kv. Unless otherwise specified, bodies for valves 40 mm and smaller shall be brass or bronze, with threaded or union ends; bodies for 50 mm valves shall have threaded ends; and bodies for valves 50 to 80 mm shall be of brass, bronze or iron. Bodies for valves 65 mm and larger shall be provided with flanged-end connections. Valve Kv shall be within 100 to 125 percent of the Kv shown.

2.5.1 Butterfly Valve Assembly

Butterfly valves shall be threaded lug type suitable for dead-end service and modulation to the fully-closed position, with carbon-steel bodies and noncorrosive discs, stainless steel shafts supported by bearings, and EPDM seats suitable for temperatures from minus 29 to plus 121 degrees C. Valves shall have a manual means of operation independent of the actuator. The rated Kv for butterfly valves shall be the value Kv at 70% open (60 degrees open).

2.5.2 Two-Way Valves

Two-way modulating valves shall have equal-percentage characteristics.

2.5.3 Three-Way Valves

Three-way valves shall provide linear flow control with constant total flow throughout full plug travel.

2.5.4 Valves for Glycol Service

Internal valve trim shall be bronze except that valve stems may be type 316 stainless steel. Valve Kv shall be within 100 to 125 percent of the Kv required. Valves 100 mm and larger shall be butterfly.

2.5.5 Valves for Hot-Water Service

For hot water service below 122 degrees C internal trim (including seats, seat rings, modulating plugs, and springs) of valves controlling water hotter than 99 degrees C shall be Type 316 stainless steel. Internal trim for valves controlling water 99 degrees C or less shall be brass or bronze. Nonmetallic parts of hot-water control valves shall be suitable for a minimum continuous operating temperature of 121 degrees C or 28 degrees C above the system design temperature, whichever is higher.

Valves 100 mm and larger shall be butterfly valves.

2.5.6 Valves for Steam Service

Bodies for valves 100 mm and larger shall be iron. Internal valve trim shall be Type 316 stainless steel. Valve Kv shall be not less than required nor greater than the Kv of the manufacturer's next larger size.

2.6 DAMPERS

2.6.1 Damper Assembly

A single damper section shall have blades no longer than 1.2 m and shall be no higher than 1.8 m. Maximum damper blade width shall be 203 mm. Larger sizes shall be made from a combination of sections. Dampers shall be steel, or other materials where shown. Flat blades shall be made rigid by folding the edges. Blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section shall not be located directly in the air stream. Damper axles shall be 13 mm minimum, plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings. Pressure drop through dampers shall not exceed 10 Pa at 5.1 m/s in the wide-open position. Frames shall not be less than 50 mm in width. Dampers shall be tested in accordance with AMCA 500-D.

2.6.2 Operating Links

Operating links external to dampers, such as crankarms, connecting rods, and line shafting for transmitting motion from damper actuators to dampers, shall withstand a load equal to at least twice the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be brass, bronze, zinc-coated steel, or stainless steel. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crankarms shall control the open and closed positions of dampers.

2.6.3 Damper Types

Dampers shall be parallel-blade type.

2.6.3.1 Outside Air, Return Air, and Relief Air Dampers

Outside air, return air and relief air dampers shall be provided where shown. Blades shall have interlocking edges and shall be provided with compressible seals at points of contact. The channel frames of the dampers shall be provided with jamb seals to minimize air leakage. Dampers shall not leak in excess of 102 L/s per square meter at 1017 Pa static pressure when closed. Seals shall be suitable for an operating temperature range of minus 40 to plus 94 degrees C. Dampers shall be rated at not less than 10 m/s air velocity.

2.6.3.2 Mechanical and Electrical Space Ventilation Dampers

Mechanical and electrical space ventilation dampers shall be as shown.

Dampers shall not leak in excess of 406 L/s per square meter at 1017 Pa static pressure when closed. Dampers shall be rated at not less than 7.6 m/s air velocity.

2.6.4 Damper End Switches

Each end switch shall be a hermetically sealed switch with a trip lever and over-travel mechanism. The switch enclosure shall be suitable for mounting on the duct exterior and shall permit setting the position of the trip lever that actuates the switch. The trip lever shall be aligned with the damper blade.

2.7 SMOKE DETECTORS

Duct smoke detectors shall be installed by the HVAC Contractor in supply and exhaust air ducts in accordance with NFPA 90A. Detectors will be furnished and tied to the building fire alarm system by the Electrical Contractor. Duct smoke detectors shall conform to the requirements of UL 268A. Duct smoke detectors shall have perforated sampling tubes extended into the air duct. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have manual reset. Detectors shall be rated for air velocities that include air flows between 2.5 and 20 m/s. Detectors shall be powered from the fire alarm control panel (FACP). Detectors shall have two sets of normally open alarm contacts and two sets of normally closed alarm contacts. Detectors shall be connected to the building fire alarm panel for alarm initiation. A remote annunciation lamp and accessible remote reset switch shall be provided for duct detectors that are mounted eight feet or more above the finished floor and for detectors that are not readily visible. Remote lamps and switches as well as the affected fan units shall be properly identified in etched rigid plastic placards.

2.8 INSTRUMENTATION

2.8.1 Measurements

Transmitters shall be calibrated to provide the following measurements, over the indicated ranges, for an output of 4 to 20 mAdc:

- a. Conditioned space temperature, from 10 to 30 degrees C .
- b. Duct temperature, from 5 to 60 degrees C .
- c. Heating hot-water temperature, from 10 to 121 degrees C .
- d. Outside-air temperature, from minus 70 to plus 55 degrees C .
- e. Relative humidity, 0 to 100 percent for space and duct high-limit applications.
- f. Pitot-tube air-flow measurement station and transmitter, from 0 to 25 Pa for flow velocities of 3.5 to 6 m/s , 0 to 60 Pa for velocities of 3.5 to 9 m/s , or 0 to 125 Pa for velocities of 3.5 to 13 m/s .

g. Electronic air-flow measurement station and transmitter, from 0.6 to 13 m/s .

2.8.2 Temperature Instruments

2.8.2.1 Resistance Temperature Detectors (RTD)

Temperature sensors shall be 100 ohms 3- or 4-wire RTD. Each RTD shall be platinum with a tolerance of 0.30 degrees C at 0 degrees C with a temperature coefficient of resistance (TCR) of 0.00385 ohms/ohm/deg C and shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper. Each RTD shall be furnished with an RTD transmitter as specified, integrally mounted unless otherwise shown.

2.8.2.2 Continuous Averaging RTD

Continuous averaging RTDs shall have a tolerance of plus or minus 0.5 degrees C at the reference temperature, and shall be of sufficient length to ensure that the resistance represents an average over the cross section in which it is installed. The sensing element shall have a bendable copper sheath. Each averaging RTD shall be furnished with an RTD transmitter to match the resistance range of the averaging RTD.

2.8.2.3 RTD Transmitter

The RTD transmitter shall match the resistance range of the RTD. The transmitter shall be a two-wire, loop powered device. The transmitter shall produce a linear 4-to-20 mA_{dc} output corresponding to the required temperature measurement. The output error shall not exceed 0.1 percent of the calibrated measurement.

2.8.3 Relative Humidity Instruments

A relative-humidity instrument for indoor application shall have a measurement range from 0 to 100 percent relative-humidity and be rated for operation at ambient air temperatures within the range of minus 4 to plus 55 degrees C . It shall be capable of being exposed to a condensing air stream (100 percent RH) with no adverse effect to the sensor's calibration or other harm to the instrument. The instrument shall be of the wall-mounted or duct-mounted type, as required by the application, and shall be provided with any required accessories. Instruments used in duct high-limit applications shall have a bulk polymer resistive sensing element. Duct-mounted instruments shall be provided with a duct probe designed to protect the sensing element from dust accumulation and mechanical damage. The instrument (sensing element and transmitter) shall be a two-wire, loop-powered device and shall have an accuracy of plus or minus three percent of full scale within the range of 20 to 80 percent relative humidity. The instrument shall have a typical long-term stability of 1 percent or less drift per year. The transmitter shall convert the sensing element's output to a linear 4-20 mA_{dc} output signal in proportion to the measured relative-humidity value. The transmitter shall include offset and span adjustments.

2.8.4 Electronic Airflow Measurement Stations and Transmitters

2.8.4.1 Stations

Each station shall consist of an array of velocity sensing elements and an air-flow straightener. Air-flow straightener shall be contained in a flanged sheet metal or aluminum casing. The velocity sensing elements shall be of the RTD or thermistor type, producing a temperature compensated output. The sensing elements shall be distributed across the duct cross section in the quantity and pattern specified by the published application data of the station manufacturer. The resistance to air flow through the airflow measurement station shall not exceed 20 Pa at an airflow of 10 m/s .

Station construction shall be suitable for operation at airflows of up to 25 m/s over a temperature range of 4 to 49 degrees C , and accuracy shall be plus or minus three percent over a range of 0.6 to 12.5 m/s . In outside air measurement or in low-temperature air delivery applications, the station shall be certified by the manufacturer to be accurate as specified over a temperature range of minus 29 to plus 49 degrees C . In outside air measurement applications, the air flow straightener shall be constructed of 3 mm aluminum honeycomb and the depth of the straightener shall not be less than 40 mm .

2.8.4.2 Transmitters

Each transmitter shall produce a linear, 4-to-20 mAdc, output corresponding to the required velocity pressure measurement. The transmitter shall be a two-wire, loop powered device. The output error of the transmitter shall not exceed 0.5 percent of the calibrated measurement.

2.8.5 Pitot Tube Airflow Measurement Stations and Transmitters

2.8.5.1 Stations

Each station shall contain an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements shall be of the multiple pitot tube type with averaging manifolds. The sensing elements shall be distributed across the duct cross section in the quantity and pattern specified by the published installation instructions of the station manufacturer. The resistance to air flow through the airflow measurement station shall not exceed 20 Pa at an airflow of 10 m/s . Station construction shall be suitable for operation at airflows of up to 25 m/s over a temperature range of 4 to 49 degrees C , and accuracy shall be plus or minus three percent over a range of 2.5 to 12.5 m/s . This device will not be used if the required velocity measurement is below 3.5 m/s or for outside airflow measurements.

2.8.5.2 Transmitters

Each transmitter shall produce a linear 4-to-20 mAdc output corresponding to the required velocity pressure measurement. Each transmitter shall have a low range differential pressure sensing element. The transmitter shall be a two-wire, loop powered device. Sensing element accuracy shall be plus or minus one percent of full scale, and overall transmitter accuracy shall be plus or minus 0.25 percent of the calibrated measurement.

2.8.6 Differential Pressure Instruments

The instrument shall be a pressure transmitter with an integral sensing element. The instrument over pressure rating shall be 300 percent of the operating pressure. The sensor/transmitter assembly accuracy shall be plus or minus two percent of full scale. The transmitter shall be a two-wire, loop-powered device. The transmitter shall produce a linear 4-to-20 mAdc output corresponding to the required pressure measurement.

2.8.7 Thermowells

Thermowells shall be Series 300 stainless steel with threaded brass plug and chain, 50 mm lagging neck and extension type well. Inside diameter and insertion length shall be as required for the application.

2.8.8 Sunshields

Sunshields for outside air temperature sensing elements shall prevent the sun from directly striking the temperature sensing elements. The sunshields shall be provided with adequate ventilation so that the sensing element responds to the ambient temperature of the surroundings. The top of each sunshield shall have a galvanized metal rainshield projecting over the face of the sunshield. The sunshields shall be painted white.

2.9 THERMOSTATS

Thermostat ranges shall be selected so that the setpoint is adjustable without tools between plus or minus 5 degrees C of the setpoint shown. Thermostats shall be electronic or electric.

2.9.1 Nonmodulating Room Thermostats

Contacts shall be single-pole double-throw (SPDT), hermetically sealed, and wired to identified terminals. Maximum differential shall be 3 degrees C. Room thermostats shall be enclosed with separate locking covers (guards).

2.9.2 Microprocessor Based Room Thermostats

Microprocessor based thermostats shall have built-in keypads for scheduling of day and night temperature settings. When out of the scheduling mode, thermostats shall have continuous display of time, with AM and PM indicator, continuous display of day of week, and either continuous display of room temperature with display of temperature setpoint on demand, or continuous display of temperature setpoint with display of room temperature on demand. In the programmable mode, the display shall be used for interrogating time program ON-OFF setpoints for all seven days of the week.

The time program shall allow two separate temperature setback intervals per day. The thermostats shall have a means for temporary and manual override of the program schedule, with automatic program restoration on the following day. Thermostats shall have a replaceable battery to maintain the timing and maintain the schedule in memory for one year in the event of a power outage. Maximum differential shall be 1 degree C. When used for heat pump applications, the thermostat shall have an emergency heat switch.

2.9.3 Modulating Room Thermostats

Modulating room thermostats shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Each thermostat shall have an adjustable throttling range of 2 to 4 degrees C for each output. Room thermostats shall be enclosed with separate locking covers (guards).

2.9.4 Nonmodulating Capillary Thermostats and Aquastats

Each thermostat shall have a capillary length of at least 1500 mm, shall have adjustable direct-reading scales for both setpoint and differential, and shall have a differential adjustable from 3 to 9 degrees C. Aquastats shall be of the strap on type, with 5 degrees C fixed differential.

2.9.5 Freezestats

Freezestats shall be manual reset, low temperature safety thermostats, with NO and NC contacts and a 6000 mm element which shall respond to the coldest 450 mm segment.

2.9.6 Modulating Capillary Thermostats

Each thermostat shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Thermostats shall have adjustable throttling ranges of 2 to 4 degrees C for each output.

2.9.7 Heating Thermostat

Heating thermostats shall be provided with fixed heat anticipation and shall have a single-pole, single-throw (SPST) switch hermetically sealed and actuated by a bimetallic or bellows type element. Thermostats shall be provided with external temperature setting devices with a factory set maximum of 23.3 degrees C. Heating thermostats shall have an adjustable range of at least 7 degrees below 23.3 degrees C.

2.9.8 Ventilation Thermostats for Mechanical Room Ventilation Systems

Thermostats shall be provided with fixed rising temperature anticipation heater and shall have a single-pole, single-throw (SPST) switch hermetically sealed and actuated by a bimetallic or bellows type element. Thermostats shall be provided with external temperature setting devices with a factory set minimum.

2.10 PRESSURE SWITCHES AND SOLENOID VALVES

2.10.1 Pressure Switches

Each switch shall have an adjustable setpoint with visible setpoint scale. Range shall be as shown. Differential adjustment shall span 20 to 40 percent of the range of the device.

2.10.2 Differential-Pressure Switches

Each switch shall be an adjustable diaphragm-operated device with two SPDT contacts, with taps for sensing lines to be connected to duct pressure fittings designed to sense air pressure. These fittings shall be of the angled-tip type with tips pointing into the air stream. The setpoint shall not be in the upper or lower quarters of the range and the range shall not be more than three times the setpoint. Differential shall be a maximum of 35 Pa at the low end of the range and 85 Pa at the high end of the range.

2.11 INDICATING DEVICES

2.11.1 Thermometers

Mercury shall not be used in thermometers.

2.11.1.1 Piping System Thermometers

Piping system thermometers shall have brass, malleable iron or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 230 mm scale. Thermometers for piping systems shall have rigid stems with straight, angular, or inclined pattern.

2.11.1.2 Piping System Thermometer Stems

Thermometer stems shall have expansion heads as required to prevent breakage at extreme temperatures. On rigid-stem thermometers, the space between bulb and stem shall be filled with a heat-transfer medium.

2.11.1.3 Nonaveraging Air-Duct Thermometers

Air-duct thermometers shall have perforated stem guards and 45-degree adjustable duct flanges with locking mechanism.

2.11.1.4 Averaging Air-Duct Thermometers

Averaging thermometers shall have a 90 mm (nominal) dial, with black legend on white background, and pointer traveling through a 270-degree arc.

2.11.1.5 Accuracy

Thermometers shall have an accuracy of plus or minus one percent of scale range. Thermometers shall have a range suitable for the application.

2.11.2 Pressure Gauges

Gauges shall be 50 mm (nominal) size, back connected, suitable for field or panel mounting as required, shall have black legend on white background, and shall have a pointer traveling through a 270-degree arc. Accuracy shall be plus or minus three percent of scale range. Gauges shall meet requirements of ASME B40.100.

2.11.2.1 Hydronic System Gauges

Gauges for hydronic system applications shall have ranges and graduations as shown.

2.11.3 Low Differential Pressure Gauges

Gauges for low differential pressure measurements shall be a minimum of 90 mm (nominal) size with two sets of pressure taps, and shall have a diaphragm-actuated pointer, white dial with black figures, and pointer zero adjustment. Gauges shall have ranges and graduations as shown. Accuracy shall be plus or minus two percent of scale range.

2.12 CONTROL DEVICES AND ACCESSORIES

2.12.1 Relays

Control relay contacts shall have utilization category and ratings selected for the application, with a minimum of two sets of contacts (two normally open, two normally closed) enclosed in a dustproof enclosure. Relays shall be rated for a minimum life of one million operations. Operating time shall be 20 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage. Time delay relays shall be 2PDT with eight-pin connectors, dust cover, and a matching rail-mounted socket. Adjustable timing range shall be 0 to 5 minutes. Power consumption shall not be greater than three watts.

2.12.2 Joule or Watthour Meters

Joule meters shall be in accordance with ANSI C12.1 and have pulse initiators for remote monitoring of Joule consumption. Pulse initiator shall consist of form C contacts with a current rating not to exceed two amperes and voltage not to exceed 500 V, with combinations of VA not to exceed 100 VA, and a life rating of one billion operations. Meter sockets shall be in accordance with ANSI C12.1.

2.12.3 Joule or Watthour Meters with Demand Register

Meters shall be in accordance with ANSI C12.1 and shall have pulse initiators for remote monitoring of Joule consumption and instantaneous demand. Pulse initiators shall consist of form C contacts with a current rating not to exceed two amperes and voltage not to exceed 500 V, with combinations of VA not to exceed 100 VA, and a life rating of one billion operations. Meter sockets shall be in accordance with ANSI C12.1

2.12.4 Joule or Watthour Transducers

Joule transducers shall have an accuracy of plus or minus 0.25 percent for kW and Joule outputs from full lag to full lead power factor. Input ranges for kW and Joule transducers shall be selectable without requiring the changing of current or potential transformers. The output shall be 4 to 20 mAdc.

2.12.5 Current Sensing Relays

Current sensing relays shall provide a normally-open contact rated at a minimum of 50 volts peak and 1/2 ampere or 25 VA, noninductive. There shall be a single hole for passage of current carrying conductors. The devices shall be sized for operation at 50 percent rated current based on the connected load. Voltage isolation shall be a minimum of 600 volts.

2.12.6 Power-Line Conditioners (PLC)

Power line conditioners shall be furnished for each DDC panel. The PLCs shall provide both voltage regulation and noise rejection. The PLCs shall be of the ferro-resonant design, with no moving parts and no tap switching, while electrically isolating the secondary from the power-line side. The PLCs shall be sized for 125 percent of the actual connected kVA load. Characteristics of the PLC shall be as follows:

- a. At 85 percent load, the output voltage shall not deviate by more than plus or minus one percent of nominal when the input voltage fluctuates between minus 20 percent to plus 10 percent of nominal.
- b. During load changes of zero to full load, the output voltage shall not deviate by more than plus or minus three percent of nominal voltage. Full correction of load switching disturbances shall be accomplished within five cycles, and 95 percent correction shall be accomplished within two cycles of the onset of the disturbance.
- c. Total harmonic distortion shall not exceed 3-1/2 percent at full load.

2.13 DIRECT DIGITAL CONTROL (DDC) HARDWARE

All functions, constraints, data base parameters, operator developed programs and any other data shall be downloadable from a portable workstation/tester or the central workstation/tester to network control panels, RIU's, universal programmable controllers, and unitary controllers.

Download shall be accomplished through both the primary network and the local DDC portable workstation/tester port.

2.13.1 Network Control Panel

Network control panels shall be microcomputer-based with sufficient memory provided to perform all specified and shown network control panel functions and operations, including spare capacity for all spares and its I/O functions specified. Each network control panel and remote I/O units (RIU) shall have a minimum of 10% of its I/O functions as spare capacity but not less than 2 of each type used in each. The type of spares shall be in the same proportion as the implemented I/O functions on the panel, but in no case shall there be less than two spare points of each type. The panel I/O functions shall be furnished complete, with no changes or additions necessary to support implementation of spare functions. Output relays associated with digital signals shall be considered part of the I/O

function, whether physically mounted in the enclosure or separately mounted. Implementation of spare points shall necessitate only providing the additional field sensor or control device, field wiring including connection to the system, and point definition assignment by the operator using the central workstation/tester or portable workstation/tester. The panel shall contain all necessary I/O functions to connect to field sensors and control panels. I/O function operation shall be fully supervised to detect I/O function failures. Network control panels shall operate in an independent stand-alone mode, which is defined as all network control panel operations performed by the network control panel without any continuing input from other Direct digital controls or portable workstation/tester. The network control panel shall be capable of controlling a mix of at least 32 RIUs, unitary controllers, and universal programmable controllers.

2.13.1.1 Integral Features

The network control panel shall include:

- a. Main power switch.
- b. Power on indicator.
- c. Portable workstation/tester port, connector, and if necessary power supply.
- d. Manufacturers control network port.
- e. On-Off-Auto switches for each DO which controls a device. These switches shall be mounted in the field panel, with the exception of motors, for which the switch shall be mounted at the motor control center. On-Off-Auto switches are not required for DO associated with a status or alarm such as pilot lights. The status of these switches shall be available to the panel for further processing.
- f. Minimum-Maximum-Auto switches, or Auto-Manual switches with manual output override, for each AO. The status of these shall be available to the panel for further processing.
- g. An intrusion detection device, connected as an alarm.

2.13.1.2 Communication Interfaces

The following communication capabilities shall function simultaneously.

- a. Manufacturers Control Network. Manufacturers control network communications interfaces for each data transmission systems (DTS) circuit between network control panels and RIUs, unitary controllers, and universal programmable controllers, shall be provided. Communication interfaces shall be provided between each network control panel and associated I/O functions. The DTS will provide for transmission speeds necessary to comply with performance requirements specified. DTS equipment shall be installed in the network control panel enclosure.

b. Portable Workstation/Tester Port. A communications port for interfacing to a portable workstation/tester shall be provided. Network control panel workstation/tester port other than RS-232, shall be converted to RS-232, including cabling and power supply, and shall be permanently installed in the panel.

c. Primary Network Port. The network control panel shall either have a built in primary network Port or be capable of accepting a primary network port expansion card for future networking to a base wide utility monitoring and control system (UMCS). The primary network port expansion card shall be either Ethernet (IEEE802.3) or ARCNET.

2.13.1.3 Memory and Real Time Clock (RTC) Backup

The network control panel memory and real time clock functions shall continue to operate for a minimum of 72 hours in the event of a power failure. If rechargeable batteries are provided, automatic charging of batteries shall be provided. Whenever a either a permanent workstation/tester or portable workstation/tester is monitoring the network control panel, a low battery alarm message shall be sent to it.

2.13.1.4 Duplex Outlet

A single phase, 120 Vac electrical service outlet for use with test equipment shall be furnished either inside or within 2 meters of the network control panel enclosure.

2.13.1.5 Locking Enclosures

Locking type mounting cabinets with common keying shall be furnished for each network control panel.

2.13.1.6 Failure Mode

Upon failure of the network control panel, either due to failure of the network control panel hardware or of the manufacturers control network, the network control panel shall revert to the failure mode as shown.

a. Manufacturers Control Network Failure: Upon failure of the manufacturers control network, the network control panel shall operate in an independent stand-alone mode.

b. Network Control Panel Hardware Failure: Upon failure of the network control panel hardware, the network control panel shall cease operation and stop communications with other network control panels, RIUs, unitary controllers and universal programmable controllers connected to the affected network control panel. The affected network control panel shall respond to this failure as specified and shown.

2.13.2 RIU

The RIU shall be functionally a part of the network control panel as specified, but may be remotely located from the network control panel and communicate over a dedicated communication circuit. When remotely located, the I/O functions shall be subject to the same requirements as for the network control panel hardware. RIUs shall be used to connect remote inputs and outputs to a network control panel and shall contain all necessary I/O functions to connect to field sensors and control devices. RIU operation shall be fully supervised by the network control panel to detect failures. Each RIU shall have a minimum of 10 % of its I/O functions as spare capacity. The type of spares shall be in the same proportion as the implemented I/O functions on the RIU, but in no case shall there be less than two spare points of each type. The RIU shall be furnished complete, with no changes or additions necessary to support implementation of spare functions. Output relays associated with digital signals shall be considered part of the I/O function, whether physically mounted in the enclosure or separately mounted. Implementation of spare points by others shall require only providing the additional field sensor or control device, field wiring including connection to the system, and point definition assignment by the operator. The RIU shall either report the status of all connected points on each scan, or report the status of all points which have changed state or value since the previous scan.

2.13.2.1 Integral Features

The RIU shall include:

- a. Main power switch.
- b. Power on indicator.
- c. Portable workstation/tester port, connector, and if necessary power supply.
- d. Manufacturers control network port.
- e. On-Off-Auto switches for each DO which controls a device. These switches shall be mounted in the RIU, with the exception of motors, for which the switch shall be mounted at the motor control center. On-Off-Auto switches are not required for DO associated with a status or alarm such as pilot lights. The status of these switches shall be available to the RIU for further processing.
- f. Minimum-Maximum-Auto switches, or Auto-Manual switches with manual output override, for each AO. The status of these shall be available to the panel for further processing.
- g. An intrusion detection device, connected as an alarm.

2.13.2.2 Duplex Outlet

A single phase, 120 Vac electrical service outlet for use with test equipment shall be furnished either inside or within 2 m of the RIU.

2.13.2.3 Locking Enclosures

Locking type mounting cabinets with common keying shall be furnished for each RIU.

2.13.2.4 Failure Mode

Upon failure of the RIU, either due to failure of the RIU hardware or of the DTS, the RIU shall revert to the failure mode shown.

2.13.3 Universal Programmable Controller (UPC)

The universal programmable controller shall be a microprocessor based controller designed and programmed to control and monitor systems as shown.

Resident programs shall be contained in reprogrammable nonvolatile memory. Each universal programmable controller shall contain necessary power supplies, transformers, memory, I/O functions and communications interfaces necessary to perform its required functions and to provide control and monitoring of connected equipment and devices. It shall contain all necessary I/O functions to connect to field sensors and controls. I/O operation shall be fully supervised to detect I/O function failures. It shall provide for operation as a device connected to the system via the manufacturers control network.

2.13.3.1 Integral Features

The universal programmable controller shall include as a minimum:

- a. Main power switch.
- b. Power on indicator.
- c. Portable workstation/tester port, connector, and if necessary power supply.
- d. Manufacturers control network port.
- e. I/O functions:
 - (1) 8 DI
 - (2) 4 DO
 - (3) 8 AI
 - (4) 4 AO
 - (5) 1 PA
- f. On-Off-Auto switches for each DO which controls a device. These switches shall be mounted in the universal programmable controller, with the exception of motors, for which the switch shall be mounted at the motor control center. On-Off-Auto switches are not required for DO associated with a status or alarm such as pilot lights. The status of these switches shall be available to the panel for further processing.
- g. Minimum-Maximum-Auto switches, or Auto-Manual switches with manual

output override, for each AO. The status of these shall be available to the panel for further processing.

2.13.3.2 Communication Interfaces

The UPC shall have the following communication capabilities which shall function simultaneously.

a. Manufacturers Control Network. The manufacturers control network communications interface for a data transmission systems (DTS) circuit between the UPC and a network control panels shall be provided. The DTS will provide for transmission speeds necessary to comply with performance requirements specified. DTS equipment shall be installed in the UPC Panel enclosure.

b. Portable Workstation/Tester Port. A communications port for interfacing to a portable workstation/tester shall be provided. A UPC workstation/tester port other than RS-232, shall be converted to RS-232, including cabling and power supply, and shall be permanently installed in the panel.

2.13.3.3 Memory and RTC Backup

The UPC memory and real time clock functions shall continue to operate for a minimum of 72 hours in the event of a power failure. If rechargeable batteries are provided, automatic charging of batteries shall be provided. Whenever a either a permanent workstation/tester or portable workstation/tester is monitoring the network control panel, a low battery alarm message shall be sent to it.

2.13.3.4 Specific Requirements

Each universal programmable controller shall be accessible for purposes of application selection, control parameters, set point adjustment, and monitoring from any DDC controller connected to the same manufacturers control network as the universal programmable controller. This shall be done using a portable workstation/tester connected to a portable workstation/tester port either directly or via modem.

2.13.3.5 Locking Enclosures

Locking type mounting cabinets with common keying shall be furnished for each enclosure.

2.13.3.6 Failure Mode

Upon failure of the universal programmable controller, it shall revert to the failure mode of operation as shown.

2.13.4 Unitary Controller

The unitary controller shall be a microprocessor based, stand-alone, dedicated purpose controller, communicating with the network control panel, designed and programmed to control air distribution system mixing boxes,

terminal units, heat pumps, fan coil units, self-contained DX units or VAV boxes as shown. Each unitary controller shall contain resident programs in nonvolatile memory for each specific application implemented. Each unitary controller shall contain necessary power supplies, transformers, memory, I/O functions and communications interfaces necessary to perform its required functions and to provide control and monitoring of connected equipment and devices. It shall contain all necessary I/O functions to connect to field sensors and controls. I/O operation shall be fully supervised to detect I/O function failures and shall provide for operation as a device connected to the network control panel via the manufacturers control network.

2.13.4.1 Integral Features

The unitary controller shall include:

- a. Main power switch.
- b. Power on indicator.
- c. Portable workstation/tester port, connector, and power supply.
- d. Manufacturers control network port.
- e. All I/O functions required to implement the requirements as shown.
- f. On-Off-Auto switches for each DO which controls a device. These switches shall be mounted in the field panel, with the exception of motors, for which the switch shall be mounted at the motor control center. On-Off-Auto switches are not required for DO associated with a status or alarm such as pilot lights. The status of these switches shall be available to the panel for further processing.
- g. Minimum-Maximum-Auto switches, or Auto-Manual switches with manual output override, for each AO. The status of these shall be available to the panel for further processing.

2.13.4.2 Communication Interfaces

The unitary controller shall have the following communication capabilities which shall function simultaneously.

- a. Manufacturers Control Network. The manufacturers control network communications interface for a data transmission systems (DTS) circuit between the unitary controller and a network control panel shall be provided. The DTS will provide for transmission speeds necessary to comply with performance requirements specified. DTS equipment shall be installed in the unitary control panel enclosure.
- b. Portable Workstation/Tester Port. A communications port for interfacing to a portable workstation/tester shall be provided. A

unitary controller workstation/tester port other than RS-232, shall be converted to RS-232, including cabling and power supply, and shall be permanently installed in the panel. For unitary controller applications where the controller is not mounted in an enclosure, such as for fan-coil units or VAV terminal units, a portable conversion device for an RS-232 connection to the portable workstation/tester may be provided.

2.13.4.3 Failure Mode

Upon failure of the unitary controller, it shall revert to the failure mode of operation as shown.

2.13.5 I/O Functions

2.13.5.1 DDC Hardware I/O Functions

I/O Functions shall be provided as part of the DDC system and shall be in accordance with the following:

a. The analog input (AI) function shall monitor each analog input, perform A-to-D conversion, and hold the digital value in a buffer for interrogation. The A-to-D conversion shall have a minimum resolution of 10 bits plus sign. Signal conditioning shall be provided for each analog input. Analog inputs shall be individually calibrated for zero and span, in hardware or in software. The AI shall incorporate common mode noise rejection of 50 dB from 0 to 100 Hz for differential inputs, and normal mode noise rejection of 20 dB at 60 Hz from a source impedance of 10,000 ohms. Input ranges shall be within the range of 4-to-20 mAdc.

b. The analog output (AO) function shall accept digital data, perform D-to-A conversion, and output a signal within the range of 4-to-20 mAdc. D-to-A conversion shall have a minimum resolution of eight bits plus sign. Analog outputs shall be individually calibrated for zero and span. Short circuit protection on voltage outputs and open circuit protection on current outputs shall be provided.

c. The digital input (DI) function shall accept on-off, open-close, or other change of state (two state data) indications. Isolation and protection against an applied steady-state voltage up to 180 Vac peak shall be provided.

d. The digital output (DO) function shall provide contact closures for momentary and maintained operation of output devices. Closures shall have a minimum duration of 0.1 second. DO relays shall have an initial breakdown voltage between contacts and coil of at least 500 V peak. Electromagnetic interference suppression shall be furnished on all output lines to limit transients to nondamaging levels. Protection against an applied steady-state voltage up to 180 Vac peak shall be provided. Minimum contact rating shall be one ampere at 24 Vac.

e. The pulse accumulator function shall have the same characteristics as the DI. In addition, a buffer shall be provided to totalize pulses and allow for interrogation by the DDC system. The pulse accumulator shall accept rates up to 20 pulses per second. The totalized value shall be reset to zero upon operator's command.

f. Signal conditioning for sensors shall be provided as specified.

g. The binary coded decimal (BCD) function: The BCD function shall have the same characteristics as the DI, except that, in addition, a buffer shall be provided to totalize inputs and allow for interrogation by the network control panel. The BCD function shall have 16-channel optically isolated buffered inputs to read four digit numbers. The BCD function shall accumulate inputs at rates up to 10 inputs per second.

2.13.5.2 Failure Mode

Upon failure of the I/O function, including data transmission failure, logic power supply failure, DDC processor malfunction, software failure, interposing relay power failure, or any other failure which prevents stand alone operation of any DDC normally capable of stand alone operation, connected outputs shall be forced to the failure mode shown.

2.13.6 Central Workstation/Tester

A central workstation/tester shall be provided and shall be able to communicate any network control panel via the primary network. The central workstation/tester shall be functionally equivalent to the portable workstation/tester but is intended to be a stationary unit. The central workstation/tester shall consist of a central computer with a nominal 354 mm VGA color display, capable of displaying up to 256 colors at a minimum resolution of 640 X 480 pixels, 32 bit microprocessor operating at a minimum of 100 MHZ. The central workstation/tester shall have, as a minimum, a 2100 MB hard drive, 32 megabytes of memory, integral pointing device, serial and parallel ports, color VGA video port for an external color monitor, 89 mm floppy disk drive, CD drive, modem, PCMCIA type three slot, rechargeable battery, battery charger, 120 Vac power supply and network adapter (Ethernet IEEE802.3 or ARCNET). The central workstation/tester shall:

- a. Run DDC diagnostics.
- b. Load all DDC memory resident programs and information, including parameters and constraints.
- c. Display any AI, DI, AO, DO, or PA point in engineering units for analog points or status for digital points.
- d. Control any AO or DO.
- e. Provide an operator interface, contingent on password level,

allowing the operator to use full English language words and acronyms, or an object oriented graphical user interface.

- f. Display database parameters.
- g. Modify database parameters.
- h. Accept DDC software and information for subsequent loading into a specific DDC. Provide all necessary software and hardware required to support this function, including an EIA ANSI/EIA/TIA-232-F port.
- i. Disable/enable each DDC.
- j. Perform all workstation functions as specified.
- k. Dial up modem for alarm indication
- l. Additional slot for future lan card

2.13.7 Data Terminal Cabinet (DTC)

The DTC shall be an independent metallic enclosure not physically part of the network control panel/RIU as shown. The DTC shall be sized to accommodate the number of I/O functions required for each network control panel/RIU, including installed spares, plus 10% expansion for each type of I/O function provided. The DTC shall be divided into analog input and output groups and digital input and output groups. The DTC shall be provided with double sided screw type terminal strips. One side of the terminal strip shall be used for termination of field wiring from instrumentation-mentation and controls. The other side shall be used to connect the DTC to the network control panel/RIU. Terminal strips shall have individual terminal identification numbers. The DTC shall be a locking type mounting enclosure, with common keying and door switch wired to an input for intrusion alarm annunciation at the central station. DTC keying shall be identical to network control panel/RIU keying.

2.14 DDC SOFTWARE

All DDC software described in this specification shall be furnished as part of the complete DDC System.

2.14.1 Operating System

Each DDC shall contain an operating system that controls and schedules that DDC's activities in real time. The DDC shall maintain a point database in its memory that includes all parameters, constraints, and the latest value or status of all points connected to that DDC. The execution of DDC application programs shall utilize the data in memory resident files. The operating system shall include a real time clock function that maintains the seconds, minutes, hours, date and month, including day of the week. Each DDC real time clock shall be automatically synchronized with the network control panel real time clock at least once per day to plus or minus 10 seconds. When the network control panel is connected to a central

workstation/tester, the network control panel RTC shall be updated by the central workstation/tester RTC. The time synchronization shall be accomplished without operator intervention and without requiring system shutdown. The operating system shall allow loading of software, data files data entry, and diagnostics from the central workstation/tester both locally through the central workstation/tester port and remotely through a network control panel and the manufacturers control network.

2.14.1.1 Startup

The DDC shall have startup software that causes automatic commencement of operation without human intervention, including startup of all connected I/O functions. A DDC restart program based on detection of power failure at the DDC shall be included in the DDC software. Upon restoration of power to the DDC, the program shall restart equipment and restore loads to the state at time of power failure, or to the state as commanded by time programs or other overriding programs. The restart program shall include start time delays between successive commands to prevent demand surges or overload trips. The startup software shall initiate operation of self-test diagnostic routines. Upon failure of the DDC, if the database and application software are no longer resident or if the clock cannot be read, the DDC shall not restart and systems shall remain in the failure mode indicated until the necessary repairs are made. If the database and application programs are resident, the DDC shall resume operation after an adjustable time delay of from 0 to 600 seconds. The startup sequence for each DDC shall include a unique time delay setting for each control output when system operation is initiated.

2.14.1.2 Operating Mode

Each DDC shall control and monitor functions as specified, independent of communications with other DDC. This software shall perform all DDC functions and DDC resident application programs as specified using data obtained from I/O functions and based upon the DDC real time clock function. When communications circuits between the DDC are operable, the DDC shall obtain real time clock updates and any required global data values transmitted from other network control panels. The DDC software shall execute commands after performing constraints checks in the DDC. Status and analog values, including alarms and other data shall be transmitted from other network control panels when communications circuits are operable. If communications are not available, each DDC shall function in stand-alone mode and operational data, including the latest status and value of each point and results of calculations, normally transmitted from other network control panels shall be stored for later transmission to the network control panel. Storage for the latest 256 values shall be provided at each network control panel. Each DDC shall accept software downloaded from the network control panel. Constraints shall reside at the DDC.

2.14.1.3 Failure Mode

Upon failure for any reason, each DDC shall perform an orderly shutdown and force all DDC outputs to a predetermined (failure mode) state, consistent with the failure modes shown and the associated control device.

2.14.2 Functions

The Contractor shall provide software necessary to accomplish the following functions, as appropriate, fully implemented and operational, within each network control panel, RIU, unitary controller and universal programmable controller.

- a. Scanning of inputs.
- b. Control of outputs.
- c. Reporting of analog changes outside a selectable differential.
- d. Reporting of unauthorized digital status.
- e. Reporting of alarms automatically to network control panel.
- f. Reporting of I/O status to network control panel upon request.
- g. Maintenance of real time, updated by the network control panel at least once a day.
- h. Communication with the network control panel.
- i. Execution of DDC resident application programs.
- j. Averaging or filtering of AIs.
- k. Constraints checks (prior to command issuance).
- l. Diagnostics.
- m. Portable workstation/tester operation as specified.
- n. Reset of PA by operator based on time and value.

2.14.2.1 Analog Monitoring

The system shall measure and transmit analog values including calculated analog points. An analog change in value is defined as a change exceeding a preset differential value as specified. The record transmitted for each analog value shall include a readily identifiable flag which indicates the abnormal status of the value when it deviates from operator selectable upper and lower analog limits. Analog values shall be expressed in proper engineering units with sign. Engineering units conversions shall be provided for each measurement. Each engineering units conversion set shall include range, span, and conversion equation. A vocabulary of engineering unit descriptors shall be provided, using at least three alphanumeric characters to identify information in the system. The system shall support 255 different engineering units.

2.14.2.2 Logic (Virtual) Points

Logic (virtual) points shall be software points entered in the point database which are not directly associated with a physical I/O function. Logic (virtual) points shall be analog or digital points created by calculation from any combination of digital and analog points, or other data having the properties of real points, including alarms, without the associated hardware. Logic (virtual) points shall be defined or calculated and entered into the database by the Contractor. The calculated analog point shall have point identification in the same format as any other analog point. The calculated point shall be used in any program where the real value is not obtainable directly. Constants used in calculations shall be changeable on-line by the operator. Calculated point values shall be current for use by the system within 10 seconds of the time of any input changes.

2.14.2.3 State Variables

If an analog point represents more than two (up to eight) specific states, each state shall be nameable. For example, a level sensor shall be displayed at its measured engineering units plus a state variable with named states usable in programs or for display such as low alarm/low/normal/high/high alarm.

2.14.2.4 Analog Totalization

Any analog point shall be operator assignable to the totalization program. Up to eight analog values shall be totalized within a selectable time period. At the end of the period, the totals shall be stored. Totalization shall then restart from zero for the next time period. The program shall keep track of the peak and total value measured during the current period and for the previous period. The operator shall be able to set or reset each totalized value individually. The time period shall be able to be operator defined, modified or deleted on-line.

2.14.2.5 Energy Totalization

The system shall calculate the heat energy in Btus, for each energy source consumed by the mechanical systems specified, totalize the calculated Btus, the instantaneous rate in Btus per hour, and store totals in thousands of Btus (MBtu). The Btus calculated shall be totalized for an adjustable time period. The time period shall be defined uniquely for each Btu totalization.

2.14.2.6 Trending

Any analog or calculated point shall be operator assignable to the trend program. Up to eight points shall be sampled at individually assigned intervals, selectable between one minute and two hours. A minimum of the most recent 128 samples of each trended point shall be stored. The sample intervals shall be able to be defined, modified, or deleted on-line.

2.14.3 I/O Point Database/Parameter Definition

Each I/O point shall be defined in a database residing in the DDC. The definition shall include all physical parameters associated with each point. Each point shall be defined and entered into the database by the Contractor, including as applicable:

- a. Name.
- b. Device or sensor type (i.e., sensor, control relay, motors).
- c. Point identification number.
- d. Unit.
- e. Building number.
- f. Area.
- g. Island.
- h. DDC number and channel address.
- i. KW (running).
- j. KW (starting).
- k. Sensor range.

- l. Controller range.
- m. Sensor span.
- n. Controller span.
- o. Engineering units conversion (scale factor).
- p. Setpoint (analog).
- q. High reasonableness value (analog).
- r. Low reasonableness value (analog).
- s. High alarm limit differential (return to normal).
- t. Low alarm limit differential (return to normal).
- u. High alarm limit (analog).
- v. Low alarm limit (analog).
- w. Alarm disable time period upon startup or change of setpoint.
- x. Analog change differential (for reporting).
- y. Alarm class and associated primary message text.
- z. High accumulator limit (pulse).
- aa. Status description.
- bb. Run time target.
- cc. Failure mode as specified and shown.
- dd. Constraints as specified.

2.14.4 Alarm Processing

Each DDC shall have alarm processing software for AI, DI, and PA alarms for all real and virtual points connected to that DDC.

2.14.4.1 Digital Alarms Definition

Digital alarms are those abnormal conditions indicated by DIs as specified and shown.

2.14.4.2 Analog Alarms Definition

Analog alarms are those conditions higher or lower than a defined value, as measured by an AI. Analog readings shall be compared to predefined high and low limits, and alarmed each time a value enters or returns from a limit condition. Unique high and low limits shall be assigned to each analog point in the system. Analog alarm limits shall be stored in the DDC database. Each analog alarm limit shall have an associated unique limit differential specifying the amount by which a variable must return into the proper operating range before being annunciated as a return-to-normal-state. All limits and differentials shall be entered on-line by the operator in limits of the measured variable, without interruption or loss of monitoring of the point concerned. The program shall automatically change the high or low limits or both, of any analog point, based on time scheduled operations as specified, allowing for a time interval before the alarm limit becomes effective. In CPA applications, key the limit to a finite deviation traveling with the setpoint. The system shall automatically suppress analog alarm reporting associated with a digital point when that digital point is turned off.

2.14.4.3 Pulse Accumulator Alarms Definition

Pulse accumulator alarms are those conditions calculated from totalized values of accumulator inputs or PA input rates that are outside defined

limits as specified and shown. PA totalized values shall be compared to predefined limits and alarmed each time a value enters a limit condition. Unique limits shall be assigned to each PA point in the system. Limits shall be stored in the DDC database.

2.14.5 Constraints

2.14.5.1 Equipment Constraints Definitions

Each control point in the database shall have DDC resident constraints defined and entered by the Contractor, including as applicable:

- a. Maximum starts (cycles) per hour.
- b. Minimum off time.
- c. Minimum on time.
- d. High limit (value in engineering units).
- e. Low limit (value in engineering units).

2.14.5.2 Constraints Checks

Control devices connected to the system shall have the DDC memory resident constraints checked before each command is issued to insure that no equipment damage will result from improper operation. Each command shall be executed by the DDC only after all constraints checks have been passed. Each command point shall have unique constraints assigned. High and low "reasonableness" values or one differential "rate-of-change" value shall be assigned to each AI. Values outside the reasonableness limits shall be rejected and an alarm message sent to the network control panel or portable workstation/tester. Status changes and analog point values shall be reported to the workstation upon operator request, such as for reports, alphanumeric displays, graphic displays, and application programs. Each individual point shall be capable of being selectively disabled by the operator from a workstation/tester. Disabling a point shall prohibit monitoring and automatic control of that point.

2.14.6 Diagnostics

Each DDC shall have self-test diagnostic routines implemented in firmware. The tests shall include routines that exercise memory. Diagnostic software shall be usable in conjunction with the central workstation/tester and portable workstation/tester. The software shall display messages in English to inform the tester's operator of diagnosed problems.

2.14.7 Summer-Winter Operation Monitoring

The system shall provide software to automatically change the operating parameters, monitoring of alarm limits, and start-stop schedules for each mechanical system from summer to winter and vice-versa. The software shall provide automatic commands to applications programs to coordinate proper summer or winter operation. Change over setpoints shall be operator selectable and settable.

2.14.8 Control Sequences and Control Loops

Sufficient memory shall be provided to implement the requirements specified and shown for each DDC. Specific functions to be implemented are defined in individual system control sequences and database tables shown in the drawings, and shall include, as applicable, the following:

- a. PI Control: This function shall provide proportional control and proportional plus integral control.
- b. Two Position Control: This function shall provide control for a two state device by comparing a set point against a process variable and an established deadband.
- c. Floating Point Control: This function shall exercise control when an error signal exceeds a selected deadband, and shall maintain control until the error is within the deadband limits.
- d. Signal Selection: This function shall allow the selection of the highest or lowest analog value from a group of analog values as the basis of control. The function shall include the ability to cascade analog values so that large numbers of inputs can be reduced to one or two outputs.
- e. Signal Averaging: This function shall allow the mathematical calculation of the average analog value from a group of analog values as the basis of control. The function shall include the ability to "weight" the individual analog values so that the function output can be biased as necessary to achieve proper control.
- f. Reset Function: This function shall develop an AO based on up to two AIs and one operator specified reset schedule.
- g. Cooling/Heating Operation Program: Software shall be provided to change, either automatically or on operator command, the operating parameters, monitoring of alarm limits, and start-stop schedules for each mechanical system where such a change from cooling to heating and vice versa is meaningful. The software shall provide commands to application programs to coordinate cooling or heating mode operation. Software shall automatically switch facilities from cooling to heating, and vice versa, based on schedules or temperatures. All HVAC equipment and systems shall be assigned to the program.

2.14.9 Command Priorities

A scheme of priority levels shall be provided to prevent interaction of a command of low priority with a command of higher priority. The system shall require the latest highest priority command addressed to a single point to be stored for a period of time longer than the longest time constraint in the on and off states, insuring that the correct command shall be issued when the time constraint is no longer in effect or report the rejected command. Override commands entered by the operator shall have

higher priority than those emanating from applications programs.

2.14.10 Resident Application Software

The Contractor shall provide resident applications programs to achieve the sequences of operation, parameters, constraints, and interlocks necessary to provide control of the systems connected to the DDC system. Application programs shall be resident and shall execute in the DDC, and shall coordinate with each other, to insure that no conflicts or contentions remain unresolved. The Contractor shall coordinate the application programs specified with the equipment and controls operation, and other specified requirements. A scheme of priority levels shall be provided to prevent interaction of a command of low priority with a command of higher priority. The system shall require the latest highest priority command addressed to a single point to be stored for a period of time longer than the longest time constraint in the ON and OFF states, insuring that the correct command shall be issued when the time constraint is no longer in effect or the rejected command shall be reported. Override commands entered by the operator shall have higher priority than those emanating from application programs.

2.14.10.1 Program Inputs and Outputs

The Contractor shall select the appropriate program inputs listed for each application program to calculate the required program outputs. Where the specific program inputs are not available, a "default" value or virtual point appropriate for the equipment being controlled and the proposed sequence of operation shall be provided to replace the missing input, thus allowing the application program to operate. AIs to application programs shall have an operator adjustable deadband to preclude short cycling or hunting. Program outputs shall be real analog or digital outputs or logic (virtual) points as required to provide the specified functions. The Contractor shall select the appropriate input and output signals to satisfy the requirements for control of systems as shown.

2.14.10.2 DDC General Conditions

The Contractor shall provide software required to achieve the sequences of operation, parameters, constraints, and interlocks shown. Application software shall be resident in the DDC in addition to any other required software. In the event of a DDC failure, the controlled equipment shall continue to function in the failure mode shown.

2.14.10.3 Scheduled Start/Stop Program

This program shall start and stop equipment based on a time of day schedule for each day of the week, and on a holiday schedule. To eliminate power surges, an operator adjustable time delay shall be provided between consecutive start commands.

a. Program Inputs:

- (1) Day of week/holiday.
- (2) Time of day.

- (3) Heating high-low alarm limits.
- (4) Heating start-stop schedules.
- (5) Heating mode of operation.
- (6) Equipment status.
- (7) Equipment constraints.
- (8) Consecutive start time delay.

b. Program Outputs: Start/stop signal.

2.14.10.4 Optimum Start/Stop Program

This program shall start and stop equipment as specified for the scheduled start/stop program, but shall include a sliding schedule based on indoor and outdoor air conditions. The program shall take into account the thermal characteristics of the structure, and indoor and outdoor air conditions, using prediction software to determine the minimum time of HVAC system operation needed to satisfy space environmental requirements at the start of the occupied cycle, and determine the earliest time for stopping equipment at the day's end without exceeding space environmental requirements. An adaptive control algorithm shall be utilized to automatically adjust the constants used in the program.

a. Program Inputs:

- (1) Day of week/holiday.
- (2) Time of day.
- (3) Cooling or heating mode of operation.
- (4) Equipment status.
- (5) Heating building occupancy schedules.
- (6) Space temperature.
- (7) Building heating constant (operator adjustable and automatically optimized).
- (8) Building cooling constant (operator adjustable and automatically optimized).
- (9) OA temperature.
- (10) Required space temperature at occupancy (heating).
- (11) Required space temperature at occupancy (cooling).
- (12) Equipment constraints.
- (13) Heating high-low alarm limits.

b. Program Outputs: Start/stop signal.

2.14.10.5 Day-Night Setback Program

The software shall limit the rise or drop of space temperature (or specified fluid temperature) during unoccupied hours. Whenever the space temperature (or specified fluid temperature) is above (or below for heating) the operator assigned temperature limit, the system shall be turned on until the temperature is within the assigned temperature limit.

a. Program Inputs:

- (1) Day of week.
- (2) Time of day.

- (3) Heating mode of operation.
- (4) Heating occupancy schedules.
- (5) Equipment status.
- (6) Space temperature (or specified fluid temperature).
- (7) Minimum space temperature (or specified fluid temperature) during unoccupied periods.
- (8) Maximum space temperature (or specified fluid temperature) during unoccupied periods.
- (9) Equipment constraints.

b. Program Outputs: Start/stop signal.

2.14.10.6 Heat Recovery/Ventilation Unit Program

The software shall control unit fans, duct dampers, internal bypass, and coil valves to maintain space/supply air temperatures. This program shall be coordinated with the scheduled or optimum start-stop program for fan control. See control system points lists after this section for more requirements and information.

a. Program Inputs:

- (1) Airstream temperatures and setpoints.
- (2) On/off requirement.
- (3) Duct smoke detector status.

b. Program Outputs:

- (1) Coil valve actuator control signal.
- (2) Damper actuator control signal.
- (3) Fan start/stop.
- (4) Bypass control.

2.14.10.7 Air Volume Control Program

The software shall monitor supply air, exhaust air, and electric laundry dryer operation and modulate fan controls to maintain required air flow volumes and/or ratio or fixed differential of supply to return air flows. See control system points lists after this section for more requirements and information.

a. Program Inputs:

- (1) Supply air flow.
- (2) Dryer status.
- (3) Required supply air flow - high and low limits.
- (4) Required return/exhaust air flow - high and low limits.
- (5) Volume offset or ratio, as appropriate.
- (6) Return/exhaust air flow.

b. Program Outputs:

- (1) Supply fan volume control.
- (2) Return/exhaust fan volume control.

2.14.10.8 Miscellaneous Control Points

See control system points lists after this section for more requirements and information.

2.14.10.9 Hot Water OA Reset Program

The software shall reset the hot water temperature supplied by the boiler or converter in accordance with the OA temperature or other specified independent- dent variable. The hot water supply temperature shall be reset downward or upward from a fixed temperature proportionally, as a function of OA temperature or other specified independent variable.

a. Program Inputs:

- (1) Reset schedule.
- (2) OA dry bulb temperature or other specified independent variable.
- (3) Hot water supply temperature.
- (4) Maximum hot water supply temperature.
- (5) Minimum hot water supply temperature.
- (6) Equipment constraints.

b. Program Output: Valve actuator control signal.

2.14.10.10 Heating Plant Monitoring and Control

The software shall remotely monitor and control heating plant operation based on heat exchanger operational data. The program shall monitor inputs and discontinue heat exchanger operation if any monitored point exceeds a predetermined value or changes status incorrectly. The operator shall be able to add or delete individual program input points from the list of points that will discontinue boiler operation.

a. Program Inputs:

- (1) Steam flow.
- (2) Steam pressure.
- (3) Hot water flow.
- (4) Hot water pressure.
- (5) Hot water supply temperature.
- (6) Hot water return temperature.
- (7) Hot water KW/BTUs.
- (8) Steam temperature.
- (9) Steam KW/BTUs.

b. Program Outputs:

- (1) Heat exchanger enable/disable control signal.
- (3) Heating plant efficiency.

2.14.10.11 Hot Water Distribution Program

The software shall control the hot water distribution temperatures. The hot water distribution temperature shall be reset downward or upward from a fixed temperature proportionally as a function of OA temperature or other specified independent variable by modulating the respective zone mixing valve. The zone pump shall be stopped when the OA temperature exceeds the specified setpoint. When parallel pumps are used, the software shall alternate pump operation and shall start the standby pump (after a time delay) upon failure of the operating pump.

a. Program Inputs:

- (1) Zone hot water distribution temperature.
- (2) Reset schedule.
- (3) OA dry bulb temperature or other specified independent variable.
- (4) Maximum zone hot water distribution temperature.
- (5) Zone pump status.
- (6) Equipment constraints.

b. Program Outputs:

- (1) Zone mixing valve control.
- (2) Zone pump start/stop signal(s).

2.14.10.12 Domestic Hot Water Generator Program

The software shall control the domestic hot water temperature by adjusting the steam heating control valve.

a. Program Inputs:

- (1) Domestic hot water temperature.
- (2) Domestic hot water temperature setpoint.

b. Program Output: Steam heating control valve actuator control signal.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION CRITERIA

3.1.1 HVAC Control System

The HVAC control system shall be completely installed and ready for operation. Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exterior shall be made watertight. The HVAC control system installation shall provide clearance for control system maintenance by maintaining access space between coils, access space to mixed-air plenums, and other access space required to calibrate, remove, repair, or replace control system devices. The control system installation shall not interfere with the clearance requirements for mechanical and electrical

system maintenance.

3.1.2 Software Installation

Software shall be loaded for an operational system, including databases for all points, operational parameters, and system, command, and application software. The Contractor shall provide original and backup copies of source, excluding the general purpose operating systems and utility programs furnished by computer manufacturers and the non-job-specific proprietary code furnished by the system manufacturer, and object modules for software on each type of media utilized, within 30 days of formal Government acceptance. In addition, a copy of individual floppy disks of software for each DDC panel shall be provided.

3.1.3 Device Mounting Criteria

Devices mounted in or on piping or ductwork, on building surfaces, in mechanical/electrical spaces, or in occupied space ceilings shall be installed in accordance with manufacturer's recommendations and as shown. Control devices to be installed in piping and ductwork shall be provided with required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Strap-on temperature sensing elements shall not be used except as specified.

3.1.4 Wiring Criteria

Wiring external to control panels, including low-voltage wiring, shall be installed in metallic raceways. Nonmetallic-sheathed cables or metallic-armored cables may be installed in areas permitted by NFPA 70. Wiring shall be installed without splices between control devices and DDC panels. Instrumentation grounding shall be installed as necessary to prevent ground loops, noise, and surges from adversely affecting operation of the system. Ground rods installed by the contractor shall be tested as specified in IEEE Std 142. Cables and conductor wires shall be tagged at both ends, with the identifier shown on the shop drawings. Electrical work shall be as specified in Section 16415A ELECTRICAL WORK, INTERIOR and as shown.

3.2 CONTROL SYSTEM INSTALLATION

3.2.1 Damper Actuators

Actuators shall not be mounted in the air stream. Multiple actuators operating a common damper shall be connected to a common drive shaft. Actuators shall be installed so that their action shall seal the damper to the extent required to maintain leakage at or below the specified rate and shall move the blades smoothly.

3.2.2 Room Instrument Mounting

Room instruments, such as wall mounted thermostats, shall be mounted 1.5 m above the floor unless otherwise shown. Temperature setpoint devices shall be recess mounted.

3.2.3 Freezestats

For each 2 square meters of coil face area, or fraction thereof, a freezestat shall be provided to sense the temperature at the location shown. Manual reset freezestats shall be installed in approved, accessible locations where they can be reset easily. The freezestat sensing element shall be installed in a serpentine pattern.

3.2.4 Averaging Temperature Sensing Elements

Sensing elements shall have a total element minimum length equal to 3 m per square meter of duct cross-sectional area.

3.2.5 Duct Static Pressure Sensing Elements and Transmitters

The duct static pressure sensing element and transmitter sensing point shall be located at 75% to 100% of the distance between the first and last air terminal units.

3.2.6 Indication Devices Installed in Piping and Liquid Systems

Gauges in piping systems subject to pulsation shall have snubbers. Gauges for steam service shall have pigtail fittings with cock. Thermometers and temperature sensing elements installed in liquid systems shall be installed in thermowells.

3.3 CONTROL SEQUENCES OF OPERATION

3.3.1 General Requirements - HVAC Systems

These requirements shall apply to all primary HVAC systems unless modified herein. The sequences describe the actions of the control system for one direction of change in the HVAC process analog variable, such as temperature, humidity or pressure. The reverse sequence shall occur when the direction of change is reversed.

3.3.1.1 Supply Fan Operating

Ventilation system outside air isolation dampers shall function as described for specific modes of operation. Dampers shall open before fans are allowed to start. Fans shall run in the occupied mode, and their dampers shall open. Heating coil valves shall be under control.

3.3.1.2 Supply Fan Not Operating

When a ventilation system is stopped, all interlocked fans shall stop, the outside air and relief air dampers shall close. Heating coil valves shall remain under control.

3.3.1.3 Hydronic Heating - Distribution Pump Operating

Heat-exchanger valves shall be under control.

3.3.1.4 Hydronic Heating - Distribution Pump Not Operating

Heat-exchanger valves shall close.

3.3.2 Perimeter Radiation Control Sequence

All Modes - A radiation component mounted sensor/controller shall operate its integral control valve to maintain the setpoint.

3.3.3 Unit Heater

All Modes - A wall-mounted thermostat located as shown, shall cycle the fan to maintain its setpoint.

3.3.4 Hydronic Heating with Steam/Hot Water Converter

3.3.4.1 All Modes

The DDC system shall accept a signal from a sunshielded outside air temperature sensing element and transmitter located as shown. The DDC system shall start and stop the appropriate system pumps at the outside air temperatures shown. The DDC system shall reset the hydronic heating supply temperature setpoint in a linear schedule based on the outside air temperature as shown. The DDC system shall accept a signal from a temperature sensing element and transmitter located in the hydronic heating supply line and the DDC system output shall modulate the converter steam control valve to maintain the reset schedule setpoint in the hydronic heating supply line.

3.4 COMMISSIONING PROCEDURES

3.4.1 Evaluations

The Contractor shall make the observations, adjustments, calibrations, measurements, and tests of the control systems, set the time schedule, and make any necessary control system corrections to ensure that the systems function as described in the sequence of operation.

3.4.1.1 Item Check

Signal levels shall be recorded for the extreme positions of each controlled device. An item-by-item check of the sequence of operation requirements shall be performed using Steps 1 through 4 in the specified control system commissioning procedures. Steps 1, 2, and 3 shall be performed with the HVAC system shut down; Step 4 shall be performed after the HVAC systems have been started. External input signals to the DDC system (such as starter auxiliary contacts, and external systems) may be simulated in steps 1, 2, and 3. With each operational mode signal change, DDC system output relay contacts shall be observed to ensure that they function.

3.4.1.2 Weather Dependent Test Procedures

Weather dependent test procedures that cannot be performed by simulation

shall be performed in the appropriate climatic season. When simulation is used, the actual results shall be verified in the appropriate season.

3.4.1.3 Two-Point Accuracy Check

A two-point accuracy check of the calibration of each HVAC control system sensing element and transmitter shall be performed by comparing the DDC system readout to the actual value of the variable measured at the sensing element and transmitter or airflow measurement station location. Digital indicating test instruments shall be used, such as digital thermometers, motor-driven psychrometers, and tachometers. The test instruments shall be at least twice as accurate as the specified sensing element-to-DDC system readout accuracy. The calibration of the test instruments shall be traceable to National Institute Of Standards And Technology standards. The first check point shall be with the HVAC system in the shutdown condition, and the second check point shall be with the HVAC system in an operational condition. Calibration checks shall verify that the sensing element-to-DDC system readout accuracies at two points are within the specified product accuracy tolerances. If not, the device shall be recalibrated or replaced and the calibration check repeated.

3.4.1.4 Insertion and Immersion Temperatures

Insertion temperature and immersion temperature sensing elements and transmitter-to-DDC system readout calibration accuracy shall be checked at one physical location along the axis of the sensing element.

3.4.1.5 Averaging Temperature

Averaging temperature sensing element and transmitter-to-DDC system readout calibration accuracy shall be checked every 600 mm along the axis of the sensing element in the proximity of the sensing element, for a maximum of 10 readings. These readings shall then be averaged.

3.4.2 Space Temperature Controlled Perimeter Radiation

The heating medium shall be turned on, and the thermostat temperature setpoint shall be raised. The valve shall open. The thermostat temperature shall be lowered and the valve shall close. The thermostat shall be set at the setpoint shown.

3.4.3 Unit Heater

Each space thermostat temperature setting shall be turned up so that it makes contact to turn on the unit heater fans. It shall be ensured that the unit heater fans start. Each space thermostat temperature setting shall be turned down, and the unit heater fans shall stop. The thermostats shall be set at their temperature setpoints. The results of testing of one of each type of unit shall be logged.

3.4.4 Hydronic Heating with Steam/Hot Water Converter

Installation shall be as follows:

- a. Step 1 - System Inspection: The HVAC system shall be observed in its shutdown condition. Power and main air shall be available where required. The converter valve shall be closed.
- b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature sensing element location. Each temperature shall be read at the DDC controller, and the thermometer and DDC system readings logged. The calibration accuracy of the sensing element-to-DDC system readout for outside air temperature and hydronic system supply temperature shall be checked.
- c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator, through an operator entered value to the DDC system. The proper operation of the actuators and positions for all valves shall be verified. The signal shall be varied from live zero to full range, and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced actuators move from zero stroke to full stroke in the proper direction and move the connected device in the proper direction from one extreme position to the other.
- d. Step 4 - Control System Commissioning:
 - (1) The two-point calibration sensing element-to-DDC system readout accuracy check for the outside air temperature shall be performed. Any necessary software adjustments to setpoints or parameters shall be made to achieve the outside air temperature schedule.
 - (2) A signal shall be applied to simulate that the outside air temperature is above the setpoint. It shall be verified that the appropriate pump stops. A signal shall be applied to simulate that the outside air temperature is below the setpoint. It shall be verified that the appropriate pump starts.
 - (3) The two-point calibration accuracy check of the sensing element-to-DDC system readout for the system supply temperature shall be performed. The system supply temperature setpoint shall be set for the temperature schedule as shown. Signals of 8 ma and 16 ma shall be sent to the DDC system from the outside air temperature sensor, to verify that the supply temperature setpoint changes to the appropriate values.
 - (4) The control system shall be placed in the occupied mode. The calibration accuracy check of sensing element-to-DDC system readout shall be performed for each space temperature sensor and the values logged. Each space temperature setpoint shall be set as shown. The control system shall be placed in the unoccupied mode, and it shall be verified that each space temperature setpoint changes to the unoccupied mode setting.

3.5 BALANCING, COMMISSIONING, AND TESTING

3.5.1 Coordination with HVAC System Balancing

Commissioning of the control system, except for tuning of controllers, shall be performed prior to or simultaneous with HVAC system balancing. The contractor shall tune the HVAC control system after all air system and hydronic system balancing has been completed, minimum damper positions set and a report has been issued.

3.5.2 Control System Calibration, Adjustments, and Commissioning

Control system commissioning shall be performed for each HVAC system, using test plans and procedures previously approved by the Government. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform commissioning and testing of the HVAC control system. All instrumentation and controls shall be calibrated and the specified accuracy shall be verified using test equipment with calibration traceable to NIST standards. Wiring shall be tested for continuity and for ground, open, and short circuits. Tubing systems shall be tested for leaks. Mechanical control devices shall be adjusted to operate as specified. HVAC control panels shall be pretested off-site as a functioning assembly ready for field connections, calibration, adjustment, and commissioning of the operational HVAC control system. Control parameters and logic (virtual) points including control loop setpoints, gain constants, and integral constraints, shall be adjusted before the system is placed on line. Communications requirements shall be as indicated. Written notification of any planned commissioning or testing of the HVAC Control systems shall be given to the Government at least 14 calendar days in advance.

3.5.3 Performance Verification Test

The Contractor shall demonstrate compliance of the HVAC control system with the contract documents. Using test plans and procedures previously approved by the Government, the Contractor shall demonstrate all physical and functional requirements of the project. The performance verification test shall show, step-by-step, the actions and results demonstrating that the control systems perform in accordance with the sequences of operation. The performance verification test shall not be started until after receipt by the Contractor of written permission by the Government, based on Government approval of the Commissioning Report and completion of balancing. The tests shall not be conducted during scheduled seasonal off periods of base heating and cooling systems.

3.5.4 Endurance Test

The endurance test shall be used to demonstrate the specified overall system reliability requirement of the completed system. The endurance test shall not be started until the Government notifies the Contractor in writing that the performance verification test is satisfactorily completed.

The Government may terminate the testing at any time when the system fails to perform as specified. Upon termination of testing by the Government or by the Contractor, the Contractor shall commence an assessment period as

described for Phase II. Upon successful completion of the endurance test, the Contractor shall deliver test reports and other documentation as specified to the Government prior to acceptance of the system.

a. Phase I (Testing). The test shall be conducted 24 hours per day, 7 days per week, for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized by the Government in writing.

b. Phase II (Assessment). After the conclusion of Phase I, the Contractor shall identify failures, determine causes of failures, repair failures, and deliver a written report to the Government. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and shall recommend the point at which testing should be resumed. After delivering the written report, the Contractor shall convene a test review meeting at the jobsite to present the results and recommendations to the Government. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by performing appropriate portions of the performance verification test. Based on the Contractor's report and test review meeting, the Government may require that the Phase I test be totally or partially rerun. After the conclusion of any retesting which the Government may require, the Phase II assessment shall be repeated as if Phase I had just been completed.

3.5.5 Posted and Panel Instructions

Posted and Panel Instructions, showing the final installed conditions, shall be provided for each system. The posted instructions shall consist of laminated half-size drawings and shall include the control system schematic, equipment schedule, sequence of operation, wiring diagram, communication network diagram, and valve and damper schedules. The posted instructions shall be permanently affixed, by mechanical means, to a wall near the control panel. Panel instructions shall consist of laminated letter-size sheets and shall include a Routine Maintenance Checklist and as-built configuration check sheets. Panel instructions and one copy of the Operation and Maintenance Manuals, previously described herein, shall be placed inside each control panel or permanently affixed, by mechanical means, to a wall near the panel.

3.6 TRAINING

3.6.1 Training Course Requirements

A training course shall be conducted for operating staff members designated by the Contracting Officer in the maintenance and operation of the system, including specified hardware and software. The training period, for a total of 32 hours of normal working time, shall be conducted within 30 days after successful completion of the performance verification test. The training course shall be conducted at the project site. Audiovisual equipment and six sets of all other training materials and supplies shall be provided. A training day is defined as 8 hours of classroom instruction, including two 15 minute breaks and excluding lunchtime, Monday

through Friday, during the daytime shift in effect at the training facility.

3.6.2 Training Course Content

For guidance in planning the required instruction, the Contractor shall assume that attendees will have a high school education or equivalent, and are familiar with HVAC systems. The training course shall cover all of the material contained in the Operating and Maintenance Instructions, the layout and location of each HVAC control panel, the layout of one of each type of unitary equipment and the locations of each, the location of each control device external to the panels, the location of the compressed air station, preventive maintenance, troubleshooting, diagnostics, calibration, adjustment, commissioning, tuning, and repair procedures. Typical systems and similar systems may be treated as a group, with instruction on the physical layout of one such system. The results of the performance verification test and the calibration, adjustment and commissioning report shall be presented as benchmarks of HVAC control system performance by which to measure operation and maintenance effectiveness.

-- End of Section --

POINT #		INPUTS ANALOG					INPUT DIGITAL					OUTPUTS ANALOG			OUTPUTS DIGITAL				FUNCTIONS ALARMS					FUNCTIONS CALCULATIONS			NOTES	
	STEAM-TO-WATER HEAT EXCHANGER SYSTEM	TEMP	PRESS	WATER FLOW	GPM	SPARE	STATUS	PRESS	FLOW	FREEZE	TROUBLE	SPARE	VALVE	SETPOINT	SPARE	ON/OFF	OPEN/CLOSE	WARM-UP	SPARE	HIGH	LOW	PROOF	TROUBLE	MAINT.	GPM	RUN TIME		
	P-1 on/off																											
	P-1 status																											
	P-2 on/off																											
	P-2 status																											
	SHX-1 enable																											
	SHX-2 enable																											
	HWS temp																											
	HWR temp																											
	Steam pressure																											

Note: Point names and descriptions, as well as alarms and functional calculations to be finalized with base personnel.

POINT #		INPUTS ANALOG						INPUT DIGITAL						OUTPUTS ANALOG				OUTPUTS DIGITAL				FUNCTIONS ALARMS					FUNCTIONS CALCULATIONS			NOTES
		TEMP	PRESS	WATER FLOW	GPM	HUMIDITY	SPARE	STATUS	PRESS	TEMP	FREEZE	TROUBLE	WATER	SPARE	VALVE	SETPOINT	DAMPERS	SPARE	ON/OFF	OPEN/CLOSE	WARM-UP	SPARE	HIGH	LOW	PROOF	TROUBLE	MAINT.	GPM	RUN TIME	
	MISCELLANEOUS																													
	DHW recirculating pump																													
	Loss of power to building																													
	SNCO corridor temp																													
	SNCO corridor humidity																													
	JNCO corridor temp																													
	JNCO corridor humidity																													
	Attic temp #1																													
	Attic temp #2																													
	Attic humidity																													
	Crawlspace temp #1																													
	Crawlspace temp #2																													
	Crawlspace humidity																													
	Crawlspace water #1																													
	Crawlspace water #2																													
	Arctic vestibule temp #1																													
	Arctic vestibule temp #2																													
	Arctic vestibule temp #3																													
	Sanitary heat trace #1																													
	Sanitary heat trace #2																													
	Water heat trace #1																													
	Water heat trace #2																													
	Water heat trace #3																													
	Outside temp																													
	1st floor MER temp																													
	2nd floor MER temp																													
	3rd floor MER temp																													
	1st floor MER vent sys dampers (MOD-7,8,9)																													
	2nd floor MER vent sys dampers (MOD-10,11,12)																													
	1st floor MER vent fan SF-1																													
	2nd floor MER vent fan SF-2																													
	Condensate line steam injection system high temp																													
	Condensate line steam injection system low temp																													

Note: Point names and descriptions, as well as alarms and functional calculations to be finalized with base personnel.

POINT #		INPUTS ANALOG					INPUT DIGITAL										OUTPUTS ANALOG					OUTPUTS DIGITAL					FUNCTIONS ALARMS					FUNCTIONS CALCULATIONS			NOTES
	VU-1 VENTILATION SYSTEM (Typical for VU-2 and VU-3 systems except for DSD and MOD number changes)	TEMP	HUMID	PRESS	CFM	SPARE	STATUS	PRESS	FLOW	FREEZE	SMOKE	FAS	END SW	TROUBLE	SPARE	DAMPER	VALVE	SPEED	SET POINT	SPARE	ON/OFF	OFF/SLOW	OPEN/CLOSE	WARM-UP	SPARE	HIGH	LOW	PROOF	TROUBLE	MAINT.	CFM	RUN TIME	ENTHALPY		
	SAF on/off																																		
	SAF status																																		
	EAF VFD on/off																																		
	EAF VFD status																																		
	EA VFD speed																																		
	SA airflow station																																		
	Laundry dryer #1																																		
	Laundry dryer #2																																		
	Laundry dryer #3																																		
	EA East airflow station																																		
	EA West airflow station																																		
	SA filter diff. press.																																		
	EA filter diff. press.																																		
	SA smoke detector DSD-1																																		
	EA smoke detector DSD-2																																		
	OA damper MOD-5																																		
	West EA MOD-1																																		
	East EA MOD-2																																		
	Core Area EA MOD-3																																		
	Laundry Room EA MOD-4																																		
	OAI temp																																		
	SA temp after pre-heat coil																																		
	SA temp after heat exchanger (freeze also)																																		
	Heat exchanger bypass																																		
	SA post heat coil valve																																		
	SA temp																																		
	EA temp																																		
	EA temp after heat exchanger																																		
	EA damper MOD-6																																		
	OA humidity																																		
	EA humidity																																		
	SA humidity																																		

Note: Point names and descriptions, as well as alarms and functional calculations to be finalized with base personnel.

POINT #		INPUTS ANALOG					INPUT DIGITAL					OUTPUTS ANALOG			OUTPUTS DIGITAL				FUNCTIONS ALARMS					FUNCTIONS CALCULATIONS			NOTES	
	WATER-TO-WATER HEAT EXCHANGER SYSTEM	TEMP	PRESS	WATER FLOW	GPM	SPARE	STATUS	PRESS	FLOW	FREEZE	TROUBLE	SPARE	VALVE	SETPOINT	SPARE	ON/OFF	OPEN/CLOSE	WARM-UP	SPARE	HIGH	LOW	PROOF	TROUBLE	MAINT.	GPM	RUN TIME		
	P-3 on/off																											
	P-3 status																											
	P-4 on/off																											
	P-4 status																											
	Control valve																											
	HWS temp																											
	HWR temp																											
	GHS temp																											
	GHR temp																											
	Hotside auto change over valves																											
	Cold side auto change ove valves																											

Note: Point names and descriptions, as well as alarms and functional calculations to be finalized with base personnel.

SECTION 15990A

TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS
06/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 (2002) National Standards for Total System Balance

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB TABES (1998) Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA HVACTAB (2002) HVAC Systems - Testing, Adjusting and Balancing

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

TAB Schematic Drawings and Report Forms; G

Three copies of the TAB Schematic Drawings and Report Forms, no later than 21 days prior to the start of TAB field measurements.

SD-03 Product Data

TAB Related HVAC Submittals

A list of the TAB Related HVAC Submittals, no later than 7 days after the approval of the TAB Specialist.

TAB Procedures; G

Proposed procedures for TAB, submitted with the TAB Schematic Drawings and Report Forms.

Calibration

List of each instrument to be used during TAB, stating calibration requirements required or recommended by both the TAB Standard and the instrument manufacturer and the actual calibration history of the instrument, submitted with the TAB Procedures. The calibration history shall include dates calibrated, the qualifications of the calibration laboratory, and the calibration procedures used.

Systems Readiness Check

Proposed date and time to begin the Systems Readiness Check, no later than 7 days prior to the start of the Systems Readiness Check.

TAB Execution; G

Proposed date and time to begin field measurements, making adjustments, etc., for the TAB Report, submitted with the Systems Readiness Check Report.

TAB Verification; G

Proposed date and time to begin the TAB Verification, submitted with the TAB Report.

SD-06 Test Reports

Design Review Report; G

A copy of the Design Review Report, no later than 14 days after approval of the TAB Firm and the TAB Specialist.

Systems Readiness Check; G

A copy of completed checklists for each system, each signed by the TAB Specialist, at least 7 days prior to the start of TAB Execution. All items in the Systems Readiness Check Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

TAB Report; G

Three copies of the completed TAB Reports, no later than 7 days after the execution of TAB. All items in the TAB Report shall be signed by the TAB Specialist and shall bear the seal of the

Professional Society or National Association used as the TAB Standard.

TAB Verification Report; G

Three copies of the completed TAB Verification Report, no later than 7 days after the execution of TAB Verification. All items in the TAB Verification Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

SD-07 Certificates

Ductwork Leak Testing

A written statement signed by the TAB Specialist certifying that the TAB Specialist witnessed the Ductwork Leak Testing, it was successfully completed, and that there are no known deficiencies related to the ductwork installation that will prevent TAB from producing satisfactory results.

TAB Firm; G

Certification of the proposed TAB Firm's qualifications by either AABC, NEBB, or TABB to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date that the current Certification expires. Any lapses in Certification of the proposed TAB Firm or disciplinary action taken by AABC, NEBB or TABB against the proposed TAB Firm shall be described in detail.

TAB Specialist; G

Certification of the proposed TAB Specialist's qualifications by either AABC, NEBB, or TABB to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date that the current Certification expires. Any lapses in Certification of the proposed TAB Specialist or disciplinary action taken by AABC, NEBB, or TABB against the proposed TAB Specialist shall be described in detail.

1.3 SIMILAR TERMS

In some instances, terminology differs between the Contract and the TAB Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results. The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding AABC, NEBB, or TABB requirements where differences exist.

SIMILAR TERMS

Contract Term	AABC Term	NEBB Term	TABB Term
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.	SMACNA's Procedures
TAB Specialist	TAB Engineer	TAB Supervisor	TAB Supervisor
Systems Readiness Check	Construction Phase Inspection	Field Readiness Check & Preliminary Field Procedures.	Field Readiness Check & Prelim. Field Procedures

1.4 TAB STANDARD

TAB shall be performed in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC MN-1, NEBB TABES, or SMACNA HVACTAB unless otherwise specified herein. All recommendations and suggested practices contained in the TAB Standard shall be considered mandatory. The provisions of the TAB Standard, including checklists, report forms, etc., shall, as nearly as practical, be used to satisfy the Contract requirements. The TAB Standard shall be used for all aspects of TAB, including qualifications for the TAB Firm and Specialist and calibration of TAB instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB Standard, the manufacturer's recommendations shall be adhered to. All quality assurance provisions of the TAB Standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the TAB Standard, TAB procedures shall be developed by the TAB Specialist. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the TAB Standard used (AABC, NEBB, or TABB), the requirements and recommendations contained in these procedures and requirements shall be considered mandatory.

1.5 QUALIFICATIONS

1.5.1 TAB Firm

The TAB Firm shall be either a member of AABC or certified by the NEBB or the TABB and certified in all categories and functions where measurements or performance are specified on the plans and specifications, including TAB of environmental systems, building systems commissioning and the measuring of sound and vibration in environmental systems. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit

another TAB Firm for approval. Any firm that has been the subject of disciplinary action by either the AABC, the NEBB, or the TABB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections to be performed by the TAB Firm shall be considered invalid if the TAB Firm loses its certification prior to Contract completion and must be performed by an approved successor. These TAB services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The TAB Firm shall be a subcontractor of the prime Contractor and shall be financially and corporately independent of the mechanical subcontractor, and shall report to and be paid by the prime Contractor.

1.5.2 TAB Specialist

The TAB Specialist shall be either a member of AABC, an experienced technician of the Firm certified by the NEBB, or a Supervisor certified by the TABB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC, the NEBB, or the TABB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB Specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by the approved successor.

1.6 TAB SPECIALIST RESPONSIBILITIES

All TAB work specified herein and in related sections shall be performed under the direct guidance of the TAB Specialist. The TAB Specialist shall participate in the commissioning process specified in Section 15995A COMMISSIONING OF HVAC SYSTEMS.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 DESIGN REVIEW

The TAB Specialist shall review the Contract Plans and Specifications and advise the Contracting Officer of any deficiencies that would prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a Design Review Report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.2 TAB RELATED HVAC SUBMITTALS

The TAB Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful accomplishment of all HVAC TAB. The submittals identified on this list shall be accompanied by a

letter of approval signed and dated by the TAB Specialist when submitted to the Government. The TAB Specialist shall also ensure that the location and details of ports, terminals, connections, etc., necessary to perform TAB are identified on the submittals.

3.3 TAB SCHEMATIC DRAWINGS AND REPORT FORMS

A schematic drawing showing each system component, including balancing devices, shall be provided for each system. Each drawing shall be accompanied by a copy of all report forms required by the TAB Standard used for that system. Where applicable, the acceptable range of operation or appropriate setting for each component shall be included on the forms or as an attachment to the forms. The schematic drawings shall identify all testing points and cross reference these points to the report forms and procedures.

3.4 DUCTWORK LEAK TESTING

The TAB Specialist shall witness the Ductwork Leak Testing specified in Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM and approve the results as specified in Paragraph TAB RELATED HVAC SUBMITTALS.

3.5 TESTING, ADJUSTING, AND BALANCING

3.5.1 TAB Procedures

Step by step procedures for each measurement required during TAB Execution shall be provided. The procedures shall be oriented such that there is a separate section for each system. The procedures shall include measures to ensure that each system performs as specified in all operating modes, interactions with other components (such as exhaust fans, kitchen hoods, fume hoods, relief vents, etc.) and systems, and with all seasonal operating differences, diversity, simulated loads, and pressure relationships required.

3.5.2 Systems Readiness Check

The TAB Specialist shall inspect each system to ensure that it is complete, including installation and operation of controls, and that all aspects of the facility that have any bearing on the HVAC systems, including installation of ceilings, walls, windows, doors, and partitions, are complete to the extent that TAB results will not be affected by any detail or touch-up work remaining. The TAB Specialist shall also verify that all items such as ductwork and piping ports, terminals, connections, etc., necessary to perform TAB shall be complete during the Systems Readiness Check.

3.5.3 Preparation of TAB Report

Preparation of the TAB Report shall begin only when the Systems Readiness Report has been approved. The Report shall be oriented so that there is a separate section for each system. The Report shall include a copy of the appropriate approved Schematic Drawings and TAB Related Submittals, such as pump curves, fan curves, etc., along with the completed report forms for

each system. The operating points measured during successful TAB Execution and the theoretical operating points listed in the approved submittals shall be marked on the performance curves and tables. Where possible, adjustments shall be made using an "industry standard" technique which would result in the greatest energy savings, such as adjusting the speed of a fan instead of throttling the flow. Any deficiencies outside of the realm of normal adjustments and balancing during TAB Execution shall be noted along with a description of corrective action performed to bring the measurement into the specified range. If, for any reason, the TAB Specialist determines during TAB Execution that any Contract requirement cannot be met, the TAB Specialist shall immediately provide a written description of the deficiency and the corresponding proposed corrective action necessary for proper system operation to the Contracting Officer.

3.5.4 TAB Verification

The TAB Specialist shall recheck ten percent of the measurements listed in the Tab Report and prepare a TAB Verification Report. The measurements selected for verification and the individuals that witness the verification will be selected by the Contracting Officer's Representative (COR). The measurements will be recorded in the same manner as required for the TAB Report. All measurements that fall outside the acceptable operating range specified shall be accompanied by an explanation as to why the measurement does not correlate with that listed in the TAB Report and a description of corrective action performed to bring the measurement into the specified range. The TAB Specialist shall update the original TAB report to reflect any changes or differences noted in the TAB verification report and submit the updated TAB report. If over 20 percent of the measurements selected by the COR for verification fall outside of the acceptable operating range specified, the COR will select an additional ten percent for verification. If over 20 percent of the total tested (including both test groups) fall outside of the acceptable range, the TAB Report shall be considered invalid and all contract TAB work shall be repeated beginning with the Systems Readiness Check.

3.5.5 Marking of Setting

Following approval of TAB Verification Report, the setting of all HVAC adjustment devices including valves, splitters, and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time.

3.5.6 Identification of Test Ports

The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leakage or to maintain integrity of vapor barrier.

-- End of Section --

SECTION 15995A

COMMISSIONING OF HVAC SYSTEMS

07/03

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Commissioning Team

List of team members who will represent the Contractor in the pre-commissioning checks and functional performance testing, at least 2 weeks prior to the start of pre-commissioning checks. Proposed revision to the list, prior to the start of the impacted work.

Tests

Detailed procedures for pre-commissioning checks and functional performance tests, at least 4 weeks prior to the start of pre-commissioning checks.

Pre-Commissioning Checks; G

Schedule for pre-commissioning checks and functional performance tests, at least 2 weeks prior to the start of pre-commissioning checks.

SD-06 Test Reports

Test Reports; G

Completed pre-commissioning checklists and functional performance test checklists organized by system and by subsystem and submitted as one package. The results of failed tests shall be included along with a description of the corrective action taken.

1.2 SEQUENCING AND SCHEDULING

The work described in this Section shall begin only after all work required in related Sections, including Section 15951A DIRECT DIGITAL CONTROL FOR

HVAC and Section 15990A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS, has been successfully completed, and all test and inspection reports and operation and maintenance manuals required in these Sections have been submitted and approved.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 COMMISSIONING TEAM AND CHECKLISTS

The Contractor shall designate team members to participate in the pre-commissioning checks and the functional performance testing specified herein. In addition, the Government will be represented by a representative of the Contracting Officer, the Design Agent's Representative, and the Using Agency. The team members shall be as follows:

Designation	Function
Q	Contractor's Chief Quality Control Representative
M	Contractor's Mechanical Representative
E	Contractor's Electrical Representative
T	Contractor's Testing, Adjusting, and Balancing Representative
C	Contractor's Controls Representative
D	Design Agent's Representative
O	Contracting Officer's Representative
U	Using Agency's Representative

Appendices A and B are provided as a general checklist and have been prepared to best match the various equipment selected during the design of this project. Each checklist shown in Appendices A and B shall be reviewed and modified as necessary to reflect equipment actually installed during construction of the project. The commissioning team shall review the accuracy and applicability of each item in the checklist and revise as needed. Equipment shown in the checklist but not installed for the project shall be annotated as "NA". Likewise, equipment installed but not listed in the checklist shall be added or revised accordingly. A note as to why it was added or revised shall be inserted with the reviewer's initial. The commissioning team shall also add or modify to any of the equipment checklist items as required and/or specified by the equipment manufacturer.

Acceptance by each commissioning team member of each pre-commissioning checklist item shall be indicated by initials and date, unless an "X" is shown indicating that participation by that individual is not required. Acceptance by each commissioning team member of each functional performance test checklist shall be indicated by signature and date.

3.2 TESTS

The pre-commissioning checks and functional performance tests shall be performed in a manner which essentially duplicates the checking, testing, and inspection methods established in the related Sections. Where checking, testing, and inspection methods are not specified in other Sections, methods shall be established which will provide the information

required. Testing and verification required by this section shall be performed during the Commissioning phase. Requirements in related Sections are independent from the requirements of this Section and shall not be used to satisfy any of the requirements specified in this Section. The Contractor shall provide all materials, services, and labor required to perform the pre-commissioning checks and functional performance tests. A pre-commissioning check or functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating non-Government commissioning team member of which participation is specified is not present for the test. The Contractor shall reimburse the Government for all costs associated with effort lost due to tests that are aborted. These costs shall include salary, travel costs and per diem (where applicable) for Government commissioning team members. The Contractor shall submit Test Reports as specified in the Submittals paragraph.

3.2.1 Pre-Commissioning Checks

Pre-commissioning checks shall be performed for the items indicated on the checklists in Appendix A. Deficiencies discovered during these checks shall be corrected and retested in accordance with the applicable contract requirements.

3.2.2 Functional Performance Tests

Functional performance tests shall be performed for the items indicated on the checklists in Appendix B. Functional performance tests shall begin only after all pre-commissioning checks have been successfully completed. Tests shall prove all modes of the sequences of operation, and shall verify all other relevant contract requirements. Tests shall begin with equipment or components and shall progress through subsystems to complete systems. Upon failure of any functional performance test checklist item, the Contractor shall correct all deficiencies in accordance with the applicable contract requirements. The checklist shall then be repeated until it has been completed with no errors.

APPENDIX A

PRE-COMMISSIONING CHECKLISTS

Pre-commissioning checklist - Piping

For All Piping System

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Piping complete.	___	___	X	___	X	___	___	___
b. As-built shop drawings submitted.	___	___	X	___	X	___	___	___
c. Piping flushed and cleaned.	___	___	X	___	X	___	___	___
d. Strainers cleaned.	___	___	X	___	X	___	___	___
e. Valves installed as required.	___	___	X	___	X	___	___	___
f. Piping insulated as required.	___	___	X	___	X	___	___	___
g. Thermometers and gauges installed as required.	___	___	X	___	X	___	___	___
h. Verify operation of valves.	___	___	X	___	___	___	___	___
i. Air vents installed as specified.	___	___	X	X	X	___	___	___
j. Flexible connectors installed as specified	___	___	X	X	X	___	___	___
k. Verify that piping has been labeled and valves identified as specified.	___	___	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. Hydrostatic test complete.	___	___	X	___	X	___	___	___
b. TAB operation complete.	___	___	X	___	___	___	___	___

Pre-commissioning Checklist - Ductwork

For Air Handler: All

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Ductwork complete.	___	___	X	___	X	___	___	___
b. As-built shop drawings submitted.	___	___	X	___	X	___	___	___
c. Ductwork leak test complete.	___	___	X	___	X	___	___	___

NOTE: The first bracketed item d will be used for Army projects, the second for Air Force projects.

d. Fire dampers, smoke dampers, and access doors installed as required.	___	___	X	___	X	___	___	___
e. Ductwork insulated as required.	___	___	X	___	X	___	___	___
f. Thermometers and gauges installed as required.	___	___	___	___	___	___	___	___
g. Verify open/closed status of dampers.	___	___	X	___	X	___	___	___
h. Verify smoke and fire damper operation.	___	___	X	___	___	___	___	___
i. Flexible connectors installed as specified	___	___	X	___	X	___	___	___

Testing, Adjusting, and Balancing (TAB)

a. TAB operation complete.	___	___	X	___	X	___	___	___
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Pre-commissioning Checklist - Heat Recovery/Ventilation Unit

For Ventilation Unit: All

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Vibration isolation devices installed.	___	___	X	X	X	___	___	___
b. Inspection and access doors are operable and sealed.	___	___	X	___	X	___	___	___
c. Casing undamaged.	___	___	X	X	X	___	___	___
d. Insulation undamaged.	___	___	X	X	X	___	___	___
e. Condensate drainage is unobstructed. (Visually verify drainage by pouring a cup of water into drain pan.)	___	___	X	X	X	___	___	___
f. Fan belts adjusted.	___	___	X	___	X	___	___	___
g. Manufacturer's required maintenance clearance provided.	___	___	X	X	X	___	___	___
h. Filters in place and clean	___	___	X	___	X	___	___	___
Electrical								
a. Power available to unit disconnect.	___	___	___	X	X	___	___	___
b. Power available to unit control panel.	___	___	___	X	___	___	___	___
c. Proper motor rotation verified.	___	___	___	___	X	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___
Coils								
a. Hot water piping properly connected.	___	___	X	X	X	___	___	___
b. Hot water piping pressure tested.	___	___	X	X	X	___	___	___
c. Air vents installed on water coils as specified.	___	___	X	X	X	___	___	___
d. Any damage to coil fins has been repaired.	___	___	X	___	X	___	___	___
Controls								

Pre-commissioning Checklist - Heat Recovery/Ventilation Unit

For Ventilation Unit: All

Checklist Item	Q	M	E	T	C	D	O	U
a. Control valves/actuators properly installed.	___	___	X	___	___	___	___	___
b. Control valves/actuators operable.	___	___	X	___	___	___	___	___
c. Dampers/actuators properly installed.	___	___	X	___	___	___	___	___
d. Dampers/actuators operable.	___	___	X	___	___	___	___	___
e. Verify proper location, installation and calibration of duct static pressure sensor.	___	___	X	___	___	___	___	___
f. Exhaust fan VFD operable.	___	___	X	___	___	___	___	___
g. Air handler controls system operational.	___	___	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. Construction filters removed and replaced.	___	___	X	___	___	___	___	___
b. TAB report submitted.	___	___	X	___	X	___	___	___
c. TAB results within limits specified in Section 15990A	___	___	___	___	___	___	___	___
d. TAB results for outside air intake within limits specified in Section 15990A	___	___	X	___	X	___	___	___

Pre-commissioning Checklist - Pumps

For Pump: All

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Pumps grouted in place.	___	___	X	X	X	___	___	___
b. Pump vibration isolation devices functional.	___	___	X	X	X	___	___	___
c. Pump/motor coupling alignment verified.	___	___	X	X	X	___	___	___
d. Piping system installed.	___	___	X	X	X	___	___	___
e. Piping system pressure tested.	___	___	X	X	X	___	___	___
f. Pump not leaking.	___	___	X	X	X	___	___	___
g. Field assembled couplings aligned to meet manufacturer's prescribed tolerances.	___	___	X	X	X	___	___	___
Electrical								
a. Power available to pump disconnect.	___	___	___	X	X	___	___	___
b. Pump rotation verified.	___	___	___	X	X	___	___	___
c. Control system interlocks functional.	___	___	___	X	___	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. Pressure/temperature gauges installed.	___	___	X	___	X	___	___	___
b. Piping system cleaned.	___	___	X	X	X	___	___	___
c. Chemical water treatment complete.	___	___	X	X	X	___	___	___
d. Water balance complete.	___	___	X	___	X	___	___	___
e. Water balance with design maximum flow.	___	___	X	___	X	___	___	___
f. TAB Report submitted.	___	___	X	___	X	___	___	___

Pre-commissioning Checklist - Steam/Hot Water Converter

For Converter: All

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Converter steam piping installed.	___	___	X	___	X	___	___	___
b. Converter steam piping tested.	___	___	X	X	X	___	___	___
c. Hot water piping installed.	___	___	X	___	___	___	___	___
d. Hot water piping tested.	___	___	X	X	X	___	___	___
e. Makeup water piping installed.	___	___	X	X	X	___	___	___
f. Vacuum breaker installed on shell of shell and tube unit.	___	___	X	X	X	___	___	___
g. Air vent installed as specified.	___	___	X	X	X	___	___	___
h. Manufacturer's required maintenance clearance provided.	___	___	X	X	X	___	___	___
Startup								
a. Hot water system cleaned and filled.	___	___	X	X	X	___	___	___
b. All steam traps operational.	___	___	X	X	X	___	___	___
c. All condensate return pumps operational.	___	___	___	X	___	___	___	___
d. Converter safety/protection devices tested.	___	___	X	X	X	___	___	___
e. Converter startup and checkout complete.	___	___	X	X	X	___	___	___
Controls								
a. Control valves/actuators properly installed.	___	___	X	___	___	___	___	___
b. Control valves/actuators operable.	___	___	X	___	___	___	___	___

Pre-commissioning Checklist - Unit Heater

For Unit Heater: All

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Hot water piping properly connected.	___	___	X	___	___	___	___	___
b. Hot water piping pressure tested.	___	___	X	___	___	___	___	___
c. Air vent installed on hot water coil with shutoff valve as specified.	___	___	X	X	X	___	___	___
d. Any damage to coil fins has been repaired.	___	___	X	___	X	___	___	___
e. Manufacturer's required maintenance/operational clearance provided.	___	___	X	X	X	___	___	___
Electrical								
a. Power available to unit disconnect.	___	___	___	X	___	___	___	___
b. Proper motor rotation verified.	___	___	___	X	X	___	___	___
c. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___
Controls								
a. Control valves properly installed.	___	___	X	___	___	___	___	___
b. Control valves operable.	___	___	X	X	___	___	___	___
c. Verify proper location and installation of thermostat.	___	___	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. TAB Report submitted.	___	___	X	___	X	___	___	___

Pre-commissioning Checklist - Fan

For Exhaust Fan: All

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Fan belt adjusted.	___	___	X	___	X	___	___	___
Electrical								
a. Power available to fan disconnect.	___	___	___	X	___	___	___	___
b. Proper motor rotation verified.	___	___	___	___	X	___	___	___
c. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___
Controls								
a. Control interlocks properly installed.	___	___	___	X	___	___	___	___
b. Control interlocks operable.	___	___	___	X	___	___	___	___
c. Dampers/actuators properly installed.	___	___	X	___	___	___	___	___
d. Dampers/actuators operable.	___	___	X	___	___	___	___	___
e. Verify proper location and installation of thermostat.	___	___	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. TAB results within limits specified in Section 15990A	___	___	X	___	X	___	___	___
b. TAB Report submitted.	___	___	X	___	X	___	___	___

Pre-commissioning Checklist - HVAC System Controls

For HVAC System: All

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. As-built shop drawings submitted.	___	___	X	X	___	___	___	___
b. Layout of control panel matches drawings.	___	___	X	X	___	___	___	___
c. Framed instructions mounted in or near control panel.	___	___	X	X	___	___	___	___
d. Components properly labeled (on inside and outside of panel).	___	___	X	X	___	___	___	___
e. Control components piped and/or wired to each labeled terminal strip.	___	___	X	X	___	___	___	___
f. EMCS connection made to each labeled terminal strip as shown.	___	___	X	X	___	___	___	___
g. Control wiring and tubing labeled at all terminations, splices, and junctions.	___	___	X	X	___	___	___	___
h. Shielded wiring used on electronic sensors.	___	___	X	X	___	___	___	___
Main Power and Control Air								
a. 110 volt AC power available to panel.	___	___	___	X	___	___	___	___
Testing, Commissioning, and Balancing								
a. Testing, Commissioning, and Balancing Report submitted.	___	___	X	___	___	___	___	___

APPENDIX B

FUNCTIONAL PERFORMANCE TESTS CHECKLISTS

Functional Performance Test Checklist - Pumps

For Pump: All

Prior to performing this checklist, ensure that for closed loop systems, system is pressurized and the make-up water system is operational or, for open loop systems, that the sumps are filled to the proper level.

1. Activate pump start using control system commands (all possible combination, on/auto, etc.). ON_____ AUTO_____ OFF_____

a. Verify pressure drop across strainer:

Strainer inlet pressure _____ kPa (_____ psig)
Strainer outlet pressure _____ kPa (_____ psig)

b. Verify pump inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report, pump design conditions, and pump manufacturer's performance.

	DESIGN	SYSTEM TEST	ACTUAL
Pump inlet pressure (kPa gauge)	_____	_____	_____
Pump outlet pressure (kPa gauge)	_____	_____	_____

c. Operate pump at shutoff and at 100 percent of designed flow when all components are in full flow. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (kPa gauge)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (L/s)	_____	_____

d. Operate pump at shutoff and at minimum flow or when all components are in full by-pass. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (kPa gauge)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (L/s)	_____	_____

2. Verify motor amperage each phase and voltage phase to phase and phase to ground for both the full flow and the minimum flow conditions.

a. Full flow:

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	_____

Functional Performance Test Checklist - Pumps

For Pump: All

Voltage

Voltage to ground

b. Minimum flow:

Amperage

Voltage

Voltage

Voltage to ground

PHASE 1

PHASE 2

PHASE 3

3. Unusual vibration, noise, etc.

4. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative

Contractor's Mechanical Representative

Contractor's Electrical Representative

Contractor's Testing, Adjusting and Balancing Representative

Contractor's Controls Representative

Contracting Officer's Representative

Using Agency's Representative

Functional Performance Test Checklist - Heat Recovery/Ventilation Unit

For Ventilation Unit: All

Ensure that a slight negative pressure exists on inboard side of the outside air dampers throughout the operation of the dampers. Modulate OA, RA, and EA dampers from fully open to fully closed positions.

1. Functional Performance Test: Contractor shall verify operation of unit as per specification including the following:

a. The following shall be verified when the supply and exhaust fans operating mode is initiated:

(1) All dampers in normal position and exhaust fan VFD modulate to maintain the required static pressure. _____

(2) All valves in normal position. _____

(3) System safeties allow start if safety conditions are met. _____

(4) Exhaust fan VFD shall "soft-start" fan. _____

(5) Energize all laundry dryers one at a time and verify that the system airflows are maintained.

b. Occupied mode of operation.

(1) Outside air damper open. _____

(2) Return air dampers at proper position.

(3) Exhaust air damper open. _____

(4) Exhaust fan VFD receiving signal from DDC system and modulating fan to maintain exhaust duct airflow.

(5) Hot water control valve modulating to maintain set points.

(6) Bypass damper modulating properly in response to unit sensors and controls.

d. Unoccupied mode of operation

(1) All dampers in normal position. _____

e. The following shall be verified when the supply and exhaust fans off

Functional Performance Test Checklist - Heat Recovery/Ventilation Unit

For Ventilation Unit: All
mode is initiated:

(1) All dampers in normal position. _____

(2) All valves in normal position. _____

(3) Fans de-energize. _____

f. Verify safety shut down initiated by smoke detectors. _____

g. Verify safety shut down initiated by low temperature protection
controls. _____

2. Certification: We the undersigned have witnessed the above functional
performance tests and certify that the item tested has met the performance
requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative

Contractor's Mechanical Representative

Contractor's Electrical Representative

Functional Performance Test Checklist - Steam/Hot Water Converter

For Converter: All

1. Functional Performance Test: Contractor shall demonstrate operation of heating system as per specifications including the following: Start building heating equipment to provide load for converter.

a. Verify control system energizes. _____

b. Verify converter senses hot water temperature below set point and control system modulates steam valve. _____

c. Shut off building heating equipment to remove load on heating system. Verify converter steam valve closes after load is removed. _____

2. Verify converter inlet/outlet pressure reading, compare to converter design conditions and manufacturer's performance data.

	DESIGN	ACTUAL
Converter inlet water temp (degrees C)	_____	_____
Converter outlet water temp (degrees F)	_____	_____
Converter inlet steam pressure (psig)	_____	_____
Determine water flow rate based on pressure drop through converter	_____	_____
Determine water flow rate with flow measuring device	_____	_____
Verify that temperature of water is in accordance with outdoor air reset schedule	_____	_____

3. Verify proper operation of converter safeties. _____

4. Check and report unusual vibration, noise, etc. _____

5. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Functional Performance Test Checklist - Steam/Hot Water Converter

For Converter: All

Contractor's Controls Representative

Contracting Officer's Representative

Using Agency's Representative

Functional Performance Test Checklist - HVAC Controls

For HVAC System: All

The Contracting Officer will select HVAC control systems to undergo functional performance testing. The number of systems shall not exceed 2

1. Functional Performance Test: Contractor shall verify operation of HVAC controls by performing the following tests:

a. Verify that controller is maintaining the set point by manually measuring the controlled variable with a thermometer, sling psychrometer, inclined manometer, etc.

b. Verify sensor/controller combination by manually measuring the controlled medium. Take readings from control panel display and compare readings taken manually. Record all readings.

Sensor _____
Manual measurement _____
Panel reading value _____

c. Verify system stability by changing the controller set point as follows:

- (1) Air temperature - 10 degrees F
- (2) Water temperature - 10 degrees F
- (3) Static pressure - 10 percent of set point
- (4) Relative humidity - percent (RH)

The control system shall be observed for 10 minutes after the change in set point. Instability or excessive hunting will be unacceptable.

d. Verify interlock with other HVAC controls.

e. Verify interlock with fire alarm control panel.

f. Verify interlock with EMCS.

g. Change controller set point 10 percent with EMCS and verify correct response.

2. Verify that operation of control system conforms to that specified in the sequence of operation.

3. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Functional Performance Test Checklist - HVAC Controls

For HVAC System: All

Signature and Date

Contractor's Chief Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contractor's Officer's Representative _____

Using Agency's Representative _____

-- End of Section --

SECTION 16415A

ELECTRICAL WORK, INTERIOR
06/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C39.1	(1981; R 1992) Requirements for Electrical Analog Indicating Instruments
ANSI C78.1	(1991; R 1998) For Fluorescent Lamps - Rapid-Start Types - Dimensional and Electrical Characteristics
ANSI C78.1350	(1990) Electric Lamps - 400-Watt, 100-Volt, S51 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1351	(1989) Electric Lamps - 250-Watt, 100-Volt S50 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1352	(1990) Electric Lamps - 1000-Watt, 250-Volt, S52 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1355	(1989) Electric Lamps - 150-Watt, 55-Volt S55 High-Pressure Sodium Lamps
ANSI C78.1375	(1996) 400-Watt, M59 Single-Ended Metal-Halide Lamps
ANSI C78.1376	(1996) 1000-Watt, M47 Single Ended Metal-Halide Lamps
ANSI C78.20	(1995) Incandescent Lamps A, G, PS, and Similar Shapes with E26 Medium Screw Bases
ANSI C78.21	(1995; R 1998) Incandescent Lamps - PAR and R Shapes
ANSI C78.2A	(1991) 18 & 26- Watt, Compact Fluorescent Quad Tube Lamps
ANSI C78.2B	(1992) 9 & 13-Watt, Compact Fluorescent

Quad Tube Lamps

ANSI C82.1 (1997; R 1998) Electric Lamp Ballasts,
Line Frequency Fluorescent Lamp Ballasts

ANSI C82.4 (2002) Ballasts for
High-Intensity-Discharge and Low-Pressure
Sodium Lamps (Multiple-Supply Type)

ASTM INTERNATIONAL (ASTM)

ASTM B 1 (2001) Hard-Drawn Copper Wire

ASTM B 8 (1999) Concentric-Lay-Stranded Copper
Conductors, Hard, Medium-Hard, or Soft

ASTM D 709 (2001) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C57.13 (1993) Requirements for Instrument
Transformers

IEEE C62.41 (1991) Recommended Practice for Surge
Voltages in Low-Voltage AC Power Circuits

IEEE Std 242 (2001) Recommended Practice for Protection
and Coordination of Industrial and
Commercial Power Systems - Buff Book

IEEE Std 399 (1997) Recommended Practice for Power
Systems Analysis - Brown Book

IEEE Std 81 (1983) Guide for Measuring Earth
Resistivity, Ground Impedance, and Earth
Surface Potentials of a Ground System
(Part 1) Normal Measurements

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1997) Enclosures for Electrical Equipment
(1000 Volts Maximum)

NEMA AB 1 (2002) Molded-Case Circuit Breakers,
Molded Case Switches, and Circuit-Breaker
Enclosures

NEMA FU 1 (2002) Low Voltage Cartridge Fuses

NEMA ICS 1 (2000) Industrial Control and Systems:
General Requirements

NEMA ICS 2 (2000) Industrial Controls and Systems:
Controllers, Contactors, and Overload

Relays Rated 600 Volts

NEMA ICS 3	(1993; R 2000) Industrial Control and Systems: Medium Voltage Controllers Rated 2001 to 7200 Volts AC
NEMA ICS 6	(1993; R 2001) Industrial Control and Systems: Enclosures
NEMA LE 4	(2001) Recessed Luminaires; Ceiling Compatibility
NEMA MG 1	(1998) Motors and Generators
NEMA MG 10	(2001) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA OS 1	(1996) Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA OS 2	(1998) Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
NEMA PB 1	(2000) Panelboards
NEMA RN 1	(1998) Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 13	(2000) Electrical Nonmetallic Tubing (ENT)
NEMA TC 2	(2003) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit
NEMA VE 1	(2002) Metal Cable Tray Systems
NEMA WD 1	(1999) General Color Requirements for Wiring Devices
NEMA WD 6	(2002) Wiring Devices - Dimensional Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2003) Life Safety Code
NFPA 70	(2002) National Electrical Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 18	Industrial, Scientific, and Medical Equipment
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UNDERWRITERS LABORATORIES (UL)

UL 1	(2000) Flexible Metal Conduit
UL 1004	(1994; Rev thru Feb 2001) Electric Motors
UL 1029	(1994; Rev thru Feb 2001) High-Intensity-Discharge Lamp Ballasts
UL 1242	(2000; Rev thru May 2003) Electrical Intermediate Metal Conduit -- Steel
UL 1449	(1996; Rev thru Jul 2002) Transient Voltage Surge Suppressors
UL 1569	(1999; Rev thru Mar 2003) Metal-Clad Cables
UL 1570	(1995; Rev thru Nov 1999) Fluorescent Lighting Fixtures
UL 1571	(1995; Rev thru Nov 1999) Incandescent Lighting Fixtures
UL 1572	(1995; Rev thru Nov 1999) High Intensity Discharge Lighting Fixtures
UL 1660	(2000; Rev thru Jul 2002) Liquid-Tight Flexible Nonmetallic Conduit
UL 198B	(1995) Class H Fuses
UL 198C	(1986; Rev thru Feb 1998)High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198D	(1995) Class K Fuses
UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 198G	(1988; Rev May 1988) Fuses for Supplementary Overcurrent Protection
UL 198H	(1988; Rev thru Nov 1993) Class T Fuses
UL 198L	(1995; Rev May 1995) D-C Fuses for Industrial Use
UL 20	(2000; Rev thru Jun 2003) General-Use Snap Switches
UL 360	(1996; Rev thru May 2003) Liquid-Tight Flexible Steel Conduits

UL 4	(1996; Rev thru Feb 2001) Armored Cable
UL 467	(1993; Rev thru Feb 2001) Grounding and Bonding Equipment
UL 486A	(1997; Rev thru May 2001) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486C	(2000; Rev thru Oct 2002) Splicing Wire Connectors
UL 486E	(1994; Rev thru May 2000) Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
UL 489	(2002; Rev thru May 2003) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 50	(1995; Rev thru Nov 1999) Enclosures for Electrical Equipment
UL 508	(1999; Rev thru Dec 2002) Industrial Control Equipment
UL 510	(1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 512	(1993; Rev thru Mar 1999) Fuseholders
UL 514A	(1996; Rev thru Nov 2001) Metallic Outlet Boxes
UL 514B	(1997; Rev thru Feb 2002) Fittings for Cable and Conduit
UL 514C	(1996; Rev thru Nov 2002) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 542	(1999; Rev thru Feb 2003) Lampholders, Starters, and Starter Holders for Fluorescent Lamps
UL 6	(2000; Rev thru May 2003) Rigid Metal Conduit
UL 651	(1995; Rev thru Oct 2002) Schedule 40 and 80 Rigid PVC Conduit
UL 651A	(2000; Rev thru Oct 2002) Type EB and A Rigid PVC Conduit and HDPE Conduit

UL 67	(1993; Rev thru Feb 2003) Panelboards
UL 674	(1994; Rev thru Oct 1998) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations
UL 719	(2002) Nonmetallic-Sheathed Cables
UL 797	(2000; Rev thru May 2003) Electrical Metallic Tubing -- Steel
UL 817	(2001) Cord Sets and Power-Supply Cords
UL 83	(1998; Rev thru Nov 2001) Thermoplastic-Insulated Wires and Cables
UL 844	(1995; Rev thru Mar 1999) Electric Lighting Fixtures for Use in Hazardous (Classified) Locations
UL 845	(1995; Rev thru May 2000) Motor Control Centers
UL 854	(1999; Rev thru Nov 2002) Service-Entrance Cables
UL 869A	(1998) Reference Standard for Service Equipment
UL 877	(1993; Rev thru Nov 1999) Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous (Classified) Locations
UL 886	(1994; Rev thru Apr 1999) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
UL 916	(1998; Rev thru Nov 2001) Energy Management Equipment
UL 924	(1995; Rev thru Jul 2001) Emergency Lighting and Power Equipment
UL 935	(2001) Fluorescent-Lamp Ballasts
UL 943	(1993; Rev thru Apr 2002) Ground-Fault Circuit-Interrupters
UL 98	(1994; Rev thru Jun 1998) Enclosed and Dead-Front Switches
UL Elec Const Dir	(2003) Electrical Construction Equipment Directory

1.2 GENERAL

1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated or shown.

1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment shall be properly located and readily accessible.

Lighting fixtures, outlets, and other equipment and materials shall be carefully coordinated with mechanical or structural features prior to installation and positioned according to architectural reflected ceiling plans; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement when uniform illumination is required, or asymmetrically located to suit conditions fixed by design and shown. Raceways, junction and outlet boxes, and lighting fixtures shall not be supported from sheet metal roof decks. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change. The Contractor shall coordinate the electrical requirements of the mechanical work and provide all power related circuits, wiring, hardware and structural support, even if not shown on the drawings.

1.2.3 Special Environments

1.2.3.1 Weatherproof Locations

Wiring, Fixtures, and equipment in designated locations shall conform to NFPA 70 requirements for installation in damp or wet locations.

1.2.3.2 Ducts, Plenums and Other Air-Handling Spaces

Wiring and equipment in ducts, plenums and other air-handling spaces shall be installed using materials and methods in conformance with NFPA 70 unless more stringent requirements are indicated in this specification or on the contract drawings.

1.2.4 Standard Products

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.2.5 Nameplates

1.2.5.1 Identification Nameplates

Major items of electrical equipment and major components shall be

permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Designation of motors shall coincide with their designation in the motor control center or panel. Unless otherwise specified, identification nameplates shall be made of laminated plastic in accordance with ASTM D 709 with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated plastic. The front of each panelboard, motor control center, switchgear, and switchboard shall have a nameplate to indicate the phase letter, corresponding color and arrangement of the phase conductors. The following equipment, as a minimum, shall be provided with identification nameplates:

Minimum 6.4 mm High Letters	Minimum 3.2 mm High Letters
Panelboards	Control Power Transformers
Starters	Control Devices
Safety Switches	Instrument Transformers
Motor Control Centers	
Transformers	
Equipment Enclosures	
Switchboards	

Each panel, section, or unit in motor control centers, switchgear or similar assemblies shall be provided with a nameplate in addition to nameplates listed above, which shall be provided for individual compartments in the respective assembly, including nameplates which identify "future," "spare," and "dedicated" or "equipped spaces."

1.2.6 As-Built Drawings

Following the project completion or turnover, within 30 days the Contractor shall furnish 2 sets of as-built drawings to the Contracting Officer.

1.2.7 Recessed Light Fixtures (RLF) Option

The Contractor has the option to substitute inch-pound (I-P) RLF to metric RLF. This option shall be coordinated with Section 09510 ACOUSTICAL CEILINGS.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330

SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Interior Electrical Equipment; G .

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams, and other information necessary to define the installation. Detail drawings shall show the rating of items and systems and how the components of an item and system are assembled, function together, and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission.

Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall show physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. Optional items shall be clearly identified as included or excluded. Detail drawings shall as a minimum include:

- a. Transformers.
- b. Switchgear.
- c. Motor control centers.
- d. Single line electrical diagrams including primary, metering, sensing and relaying, control wiring, and control logic.
- e. Sway bracing for suspended luminaires.

Structural drawings showing the structural or physical features of major equipment items, components, assemblies, and structures, including foundations or other types of supports for equipment and conductors. These drawings shall include accurately scaled or dimensioned outline and arrangement or layout drawings to show the physical size of equipment and components and the relative arrangement and physical connection of related components. Weights of equipment, components and assemblies shall be provided when required to verify the adequacy of design and proposed construction of foundations or other types of supports. Dynamic forces shall be stated for switching devices when such forces must be considered in the design of support structures. The appropriate detail drawings shall show the provisions for leveling, anchoring, and connecting all items during installation, and shall include any recommendations made by the manufacturer.

Electrical drawings including single-line and three-line diagrams, and schematics or elementary diagrams of each electrical system; internal wiring and field connection diagrams of each electrical device when published by the manufacturer; wiring diagrams of cabinets, panels, units, or separate mountings; interconnection diagrams that show the wiring between separate components of assemblies; field connection diagrams that show the termination of wiring routed between separate items of equipment; internal wiring diagrams of equipment showing wiring as actually provided for this project. Field wiring connections shall be clearly identified.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures, including changes in related portions of the project and the reasons why, shall be submitted with the detail drawings. Approved departures shall be made at no additional cost to the Government.

SD-03 Product Data

Fault Current and Protective Device Coordination Study

The study shall be submitted along with protective device equipment submittals. No time extensions or similar contract modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed shall be based on recommendations of this study. The Government shall not be held responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices ordered and/or procured prior to approval of the study.

Manufacturer's Catalog

Data composed of catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each item.

As-Built Drawings; G.

The as-built drawings shall be a record of the construction as installed. The drawings shall include all the information shown on the contract drawings, deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full-sized set of prints marked to reflect all

deviations, changes, and modifications. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction.

The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within ten calendar days from the time the drawings are returned to the Contractor.

Onsite Tests; G.

A detailed description of the Contractor's proposed procedures for on-site tests.

SD-06 Test Reports

Factory Test Reports; G.

Six copies of the information described below in 216 x 280 mm binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The conditions specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.

Field Test Reports; G.

Six copies of the information described below in 216 x 280 mm binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.

- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The conditions specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.
- h. Final position of controls and device settings.

SD-07 Certificates

Materials and Equipment

The label or listing of the Underwriters Laboratories, Inc., will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer. Items which are required to be listed and labeled in accordance with Underwriters Laboratories must be affixed with a UL label that states that it is UL listed. No exceptions or waivers will be granted to this requirement. Materials and equipment will be approved based on the manufacturer's published data.

For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, or other commercial standard, is acceptable.

1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with NFPA 70, recommendations of the manufacturer, and as shown.

PART 2 PRODUCTS

Products shall conform to the respective publications and other requirements specified below. Materials and equipment not listed below shall be as specified elsewhere in this section. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.1 CABLES AND WIRES

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

2.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to meet manufacturer's requirements.

2.1.2 Aluminum Conductors

Aluminum conductors shall not be used.

2.1.3 Insulation

Unless indicated otherwise, or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN, THHN, or THW conforming to UL 83, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW, THW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.1.4 Bonding Conductors

ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.1.5 Service Entrance Cables

Service entrance (SE) and underground service entrance (USE) cables, UL 854.

2.1.6 Non-metallic Sheathed Cable

UL 719, type NM or NMC.

2.1.7 Metal-Clad Cable

UL 1569; NFPA 70, Type MC cable.

2.1.8 Armored Cable

UL 4; NFPA 70, Type AC cable.

2.1.9 Mineral-Insulated, Metal-Sheathed Cable

UL listed NFPA 70, type MI cable. Sheathing containing asbestos fibers

shall not be used.

2.1.10 Flat Conductor Cable

UL listed NFPA 70, type FCC.

2.1.11 Tray Cable or Power Limited Tray Cable

UL listed; Type TC or PLTC.

2.1.12 Cord Sets and Power-Supply Cords

UL 817.

2.2 CABLE TRAYS

Cable tray shall conform to NEMA VE 1, shall form a wireway system, and shall be of nominal 100 mm depth. Cable trays shall be constructed of zinc-coated steel. Trays shall include splice and end plates, dropouts, and miscellaneous hardware. Edges, fittings, and hardware shall be finished free from burrs and sharp edges. Fittings shall have not less than the load-carrying ability of straight tray sections and shall have manufacturer's minimum standard radius. Radius of bends shall be 305 mm..

2.2.1 Trough

Trough-type cable trays shall be of a nominal 150 mm width.

2.2.2 Ladder

Ladder-type cable trays shall be of nominal 150 mm width. Rung spacing shall be on 150 mm maximum centers.

2.2.3 Cantilever

Cantilever-type, center-hung cable trays may be provided at the Contractor's option in lieu of other cable tray types specified.

2.3 TRANSIENT VOLTAGE SURGE PROTECTION

Transient voltage surge suppressors shall be provided as indicated. Surge suppressors shall meet the requirements of IEEE C62.41 and be UL listed and labeled as having been tested in accordance with UL 1449. Surge suppressor ratings shall be 120/208 volts rms, operating voltage; 60 Hz; 3-phase; 4 wire with ground; transient suppression voltage (peak let-through voltage) of 400 volts. Fuses shall not be used as surge suppression.

2.4 CIRCUIT BREAKERS

2.4.1 MOLDED-CASE CIRCUIT BREAKERS

Molded-case circuit breakers shall conform to NEMA AB 1 and UL 489 and UL 877 for circuit breakers and circuit breaker enclosures located in hazardous (classified) locations. Circuit breakers may be installed in panelboards,

switchboards, enclosures, motor control centers, or combination motor controllers.

2.4.1.1 Construction

Circuit breakers shall be suitable for mounting and operating in any position. Lug shall be listed for copper conductors only in accordance with UL 486E. Single-pole circuit breakers shall be full module size with not more than one pole per module. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multi-pole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties. All circuit breakers shall have a quick-make, quick-break overcenter toggle-type mechanism, and the handle mechanism shall be trip-free to prevent holding the contacts closed against a short-circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. All ratings shall be clearly visible.

2.4.1.2 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. The interrupting rating of the circuit breakers shall be at least equal to the available short-circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short-circuit current rating specified for the panelboards and switchboards. Molded-case circuit breakers shall have nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings in accordance with NEMA AB 1. Ratings shall be coordinated with system X/R ratio.

2.4.1.3 Thermal-Magnetic Trip Elements

Thermal magnetic circuit breakers shall be provided as shown. Automatic operation shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. The instantaneous magnetic trip shall be adjustable and accessible from the front of all circuit breakers on frame sizes above 150 amperes.

2.4.2 Solid-State Trip Elements

Solid-state circuit breakers shall be provided as shown. All electronics shall be self-contained and require no external relaying, power supply, or accessories. Printed circuit cards shall be treated to resist moisture absorption, fungus growth, and signal leakage. All electronics shall be housed in an enclosure which provides protection against arcs, magnetic interference, dust, and other contaminants. Solid-state sensing shall measure true RMS current with error less than one percent on systems with distortions through the 13th harmonic. Peak or average actuating devices are not acceptable. Current sensors shall be torodial construction, encased in a plastic housing filled with epoxy to protect against damage and moisture and shall be integrally mounted on the breaker. Where

indicated on the drawings, circuit breaker frames shall be rated for 100 percent continuous duty. Circuit breakers shall have tripping features as shown on the drawings and as described below:

- a. Long-time current pick-up, adjustable from 50 percent to 100 percent of continuous current rating.
- b. Adjustable long-time delay.
- c. Short-time current pick-up, adjustable from 1.5 to 9 times long-time current setting.
- d. Adjustable short-time delay.
- e. Short-time I^2 times t switch.
- f. Instantaneous current pick-up, adjustable from 1.5 to 9 times long-time current setting.
- g. Ground-fault pick-up, adjustable from 20 percent to 60 percent of sensor rating, but not greater than 1200 amperes. Sensing of ground-fault current at the main bonding jumper or ground strap will not be permitted. Zone-selective interlocking shall be provided as shown.
- h. Adjustable ground-fault delay.
- i. Ground-fault I^2 times t switch.
- j. Overload and short-time and ground-fault trip indicators shall be provided.

2.4.3 Current-Limiting Circuit Breakers

Current-limiting circuit breakers shall be provided as shown. Current-limiting circuit breakers shall limit the let-through I^2 times t to a value less than the I^2 times t of one-half cycle of the symmetrical short-circuit current waveform. On fault currents below the threshold of limitation, breakers shall provide conventional overload and short-circuit protection. Integrally-fused circuit breakers shall not be used.

2.4.4 SWD Circuit Breakers

Circuit breakers rated 15 amperes and intended to switch 277 volts or less fluorescent lighting loads shall be marked "SWD."

2.4.5 HACR Circuit Breakers

Circuit breakers 60 amperes or below, 240 volts, 1-pole or 2-pole, intended to protect multi-motor and combination-load installations involved in heating, air conditioning, and refrigerating equipment shall be marked "Listed HACR Type."

2.4.6 Ground Fault Circuit Interrupters

UL 943. Breakers equipped with ground fault circuit interrupters shall have ground fault class, interrupting capacity, and voltage and current ratings as indicated.

2.5 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)

Motor short-circuit protectors shall conform to UL 508 and shall be provided as shown. Protectors shall be used only as part of a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection, and shall be rated in accordance with the requirements of NFPA 70.

2.5.1 Construction

Motor short-circuit protector bodies shall be constructed of high temperature, dimensionally stable, long life, nonhygroscopic materials. Protectors shall fit special MSCP mounting clips and shall not be interchangeable with any commercially available fuses. Protectors shall have 100 percent one-way interchangeability within the A-Y letter designations. All ratings shall be clearly visible.

2.5.2 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. Letter designations shall be A through Y for motor controller Sizes 0, 1, 2, 3, 4, and 5, with 100,000 amperes interrupting capacity rating. Letter designations shall correspond to controller sizes as follows:

CONTROLLER SIZE	MSCP DESIGNATION
NEMA 0	A-N
NEMA 1	A-P
NEMA 2	A-S
NEMA 3	A-U
NEMA 4	A-W
NEMA 5	A-Y

2.6 CONDUIT AND TUBING

2.6.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797

2.6.2 Electrical Nonmetallic Tubing (ENT)

NEMA TC 13.

2.6.3 Electrical Plastic Tubing and Conduit

NEMA TC 2.

2.6.4 Flexible Conduit, Steel and Plastic

General-purpose type, UL 1; liquid tight, UL 360, and UL 1660.

2.6.5 Intermediate Metal Conduit

UL 1242.

2.6.6 PVC Coated Rigid Steel Conduit

NEMA RN 1.

2.6.7 Rigid Metal Conduit

UL 6.

2.6.8 Rigid Plastic Conduit

NEMA TC 2, UL 651 and UL 651A.

2.7 CONDUIT AND DEVICE BOXES AND FITTINGS

2.7.1 Boxes, Metallic Outlet

NEMA OS 1 and UL 514A.

2.7.2 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers

NEMA OS 2 and UL 514C.

2.7.3 Boxes, Outlet for Use in Hazardous (Classified) Locations

UL 886.

2.7.4 Boxes, Switch (Enclosed), Surface-Mounted

UL 98.

2.7.5 Fittings for Conduit and Outlet Boxes

UL 514B.

2.7.6 Fittings For Use in Hazardous (Classified) Locations

UL 886.

2.7.7 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing

UL 514B.

2.8 CONDUIT COATINGS PLASTIC RESIN SYSTEM

NEMA RN 1, Type A-40.

2.9 CONNECTORS, WIRE PRESSURE

2.9.1 For Use With Copper Conductors

UL 486A.

2.10 ELECTRICAL GROUNDING AND BONDING EQUIPMENT

UL 467.

2.10.1 Ground Rods

Ground rods shall be of copper-clad steel conforming to UL 467 not less than 15.9 mm in diameter by 2.4 meter in length of the sectional type driven full length into the earth.

2.10.2 Ground Bus

The ground bus shall be bare conductor or flat copper in one piece, if practicable.

2.11 ENCLOSURES

NEMA ICS 6 or NEMA 250 unless otherwise specified.

2.11.1 Cabinets and Boxes

Cabinets and boxes with volume greater than 0.0164 cubic meters shall be in accordance with UL 50, hot-dip, zinc-coated, if sheet steel.

2.11.2 Circuit Breaker Enclosures

UL 489.

2.11.3 Circuit Breaker Enclosures for Use in Hazardous (Classified) Locations

UL 877.

2.12 LIGHTING FIXTURES, LAMPS, BALLASTS, EMERGENCY EQUIPMENT, CONTROLS AND ACCESSORIES

The following specifications are supported and supplemented by information and details on the drawings. Additional fixtures, if shown, shall conform to this specification. Lighting equipment installed in classified hazardous locations shall conform to UL 844. Lamps, lampholders, ballasts, transformers, electronic circuitry and other lighting system components shall be constructed according to industry standards. Equipment shall be tested and listed by a recognized independent testing laboratory for the expected installation conditions. Equipment shall conform to the standards

listed below.

2.12.1 Lamps

Lamps shall be constructed to operate in the specified fixture, and shall function without derating life or output as listed in published data.

Lamps shall meet the requirements of the Energy Policy Act of 1992.

- a. Incandescent and tungsten halogen lamps shall be designed for 125 volt operation (except for low voltage lamps), shall be rated for minimum life of 2,000 hours, and shall have color temperature between 2,800 and 3,200 degrees Kelvin. Tungsten halogen lamps shall incorporate quartz capsule construction. Lamps shall comply with ANSI C78.20 and sections 238 and 270 of ANSI C78.21.
- b. Fluorescent lamps shall be green-tipped and shall have color temperature 3,500 . They shall be designed to operate with the ballasts and circuitry of the fixtures in which they will be used. Fluorescent lamps, including spares, shall be manufactured by one manufacturer to provide for color and performance consistency. Fluorescent lamps shall comply with ANSI C78.1. Fluorescent tube lamp efficiencies shall meet or exceed the following requirements.

T8, 32 watts	(4' lamp)	2800 lumens
T12,34 watts	(4' lamp)	2800 lumens
T8,59 watts	(8' lamp)	5700 lumens
T12,60 watts	(8' lamp)	5600 lumens
T8/U,31-32 watts	(U-tube)	2600 lumens
T12/U,34 watts	(U-tube)	2700 lumens

(1) Linear fluorescent lamps, unless otherwise indicated, shall be 1219 mm long 32 watt T8, 265 mA, with minimum CRI of 75. Lamps of other lengths or types shall be used only where specified or shown. Lamps shall deliver rated life when operated on instant start ballasts .

(2) Small compact fluorescent lamps shall be twin, double, or triple tube configuration as shown with bi-pin or four-pin snap-in base and shall have minimum CRI of 85. They shall deliver rated life when operated on ballasts as shown. 9 and 13 watt double tube lamps shall comply with ANSI C78.2B. 18 and 26 watt double tube lamps shall comply with ANSI C78.2A. Minimum starting temperature shall be 0 degrees C for twin tube lamps and for double and triple twin tube lamps without internal starter; and -9 degrees C for double and triple twin tube lamps with internal starter.

(3) Long compact fluorescent lamps shall be 18, 27, 39, 40, 50, or 55 watt bi-axial type as shown with four-pin snap-in base; shall have minimum CRI of 85; and shall have a minimum starting temperature of 10 degrees C . They shall deliver rated life when operated on instant start ballasts .

- c. High intensity discharge lamps, including spares, shall be manufactured by one manufacturer in order to provide color and performance consistency. High intensity discharge lamps shall be designed to operate with the ballasts and circuitry of the fixtures in which they will be used and shall have wattage, shape and base as shown. High intensity discharge lamps, unless otherwise shown, shall have medium or mogul screw base and minimum starting temperature of -29 degrees C. Metal halide lamps, unless otherwise shown, shall have minimum CRI of 65; color temperature of 4,300 degrees Kelvin; shall be -BU configuration if used in base-up position; and shall be -H or high output configuration if used in horizontal position. Lamps shall comply with all applicable ANSI C78.1350, ANSI C78.1351, ANSI C78.1352, ANSI C78.1355, ANSI C78.1375, and ANSI C78.1376.

2.12.2 Ballasts and Transformers

Ballasts or transformers shall be designed to operate the designated lamps within their optimum specifications, without derating the lamps. Lamp and ballast combinations shall be certified as acceptable by the lamp manufacturer.

- a. Low voltage incandescent transformers shall be Class II UL listed 120/12 volt or 120/24 volt step-down transformers as required for the lamps shown. Transformers shall be high power factor type and shall be rated for continuous operation under the specified load. Transformers shall be encased or encased and potted, and mounted integrally within the lighting fixture unless otherwise shown.
- b. Fluorescent ballasts shall comply with ANSI C82.1 and shall be mounted integrally within fluorescent fixture housing unless otherwise shown. Ballasts shall have maximum current crest factor of 1.7; high power factor; Class A sound rating; maximum operating case temperature of 25 degrees C above ambient; and shall be rated Class P. Unless otherwise indicated, the minimum number of ballasts shall be used to serve each individual fixture. A single ballast may be used to serve multiple fixtures if they are continuously mounted, identically controlled and factory manufactured for that installation with an integral wireway.

(1) Compact fluorescent ballasts shall comply with IEEE C62.41 Category A transient voltage variation requirements and shall be mounted integrally within compact fluorescent fixture housing unless otherwise shown. Ballasts shall have minimum ballast factor of 0.95; maximum current crest factor of 1.6; high power factor; maximum operating case temperature of 25 degrees C above ambient; shall be rated Class P; and shall have a sound rating of Class A. Ballasts shall meet FCC Class A specifications for EMI/RFI emissions. Ballasts shall operate from nominal line voltage of 120 volts at 60 Hz and maintain constant light output over a line voltage variation of $\pm 10\%$. Ballasts shall have an end-of-lamp-life detection and shut-down circuit. Ballasts shall be UL listed and shall contain no PCBs. Ballasts shall contain

potting to secure PC board, provide lead strain relief, and provide a moisture barrier.

(2) Electronic fluorescent ballasts shall comply with 47 CFR 18 for electromagnetic interference. Ballasts shall withstand line transients per IEEE C62.41, Category A. Ballasts shall have total harmonic distortion between 10 and 20%; minimum frequency of 20,000Hz; filament voltage between 2.5 and 4.5 volts; maximum starting inrush current of 20 amperes; and shall comply with the minimum Ballast Efficacy Factors shown in the table below. Minimum starting temperature shall be 10 degrees C . Ballasts shall carry a manufacturer's full warranty of three years, including a minimum \$10 labor allowance per ballast.

ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTORS

LAMP TYPE	TYPE OF STARTER & LAMP	NOMINAL OPERATIONAL VOLTAGE	NUMBER OF LAMPS	MINIMUM BALLAST EFFICACY FACTOR
32W T8	rapid	120 or 277 V	1	2.54
	start		2	1.44
	linear &		3	0.93
	U-tubes		4	0.73
34W T12	rapid	120 or 277 V	1	2.64
	start		2	1.41
	linear & U-tubes		3	0.93
59W T8	rapid start linear	120 or 277 V	2	0.80
60W T12	rapid start linear	120 or 277 V	2	0.80

(3) Magnetic fluorescent ballasts shall be energy-saving, automatic resetting type, approved for the application by the Certified Ballast Manufacturers and complying with ANSI C82.1 and UL 935. Minimum ballast starting temperature shall be 4.4 degrees C for normal service and -18 degrees C where cold temperature service is required. Magnetic fluorescent ballasts shall have a ballast factor not less than shown in the following table:

MAGNETIC FLUORESCENT BALLAST FACTORS*

Design starting temperature above 4.4 degrees C with 60 Hz input frequency

MAGNETIC FLUORESCENT BALLAST FACTORS*

LAMP TYPE	NUMBER OF LAMPS	NOMINAL OPERATIONAL INPUT VOLTAGE	TYPE OF STARTER & LAMP	MIN. BALLAST FACTOR
25W F25T8	1	120v	rapid start	.96
	1	277v		.96
	2	120v		.95
	2	277v		.94
32W F32T8	1	120v	rapid start	.96
	1	277v		.95
	2	120v		.85
	2	277v		.96
96W F96T8	1	120 or 277v	instant start	1.10
	2			.85

* For ballasts not specifically designed for use with dimming controls.

(4) Dimming fluorescent ballasts shall be electronic and shall comply with the applicable electronic ballast specifications shown above. Dimming ballasts shall be compatible with the specified dimming control equipment and shall operate the lamps shown in the range from full rated light output to 20 percent of full rated light output. Dimming ballasts shall provide smooth square law dimming such that perceived dimming action is proportionate to the motion of the dimming control. Single or two-lamp dimming ballasts shall be used. Multi-lamp dimming ballasts shall be designed to operate lamps of the same length and current rating.

(5) Dimming compact fluorescent ballasts shall be electronic and shall comply with the applicable compact fluorescent and dimming ballast specifications shown above. Ballasts shall operate the lamps shown in the range from full rated light output to 5 percent of full rated light output. Ballast power factor shall be <90% throughout dimming range. THD shall be <10% at maximum light output and <20% at minimum light output. Ballast shall ignite the lamps at any light output setting selected.

- c. High intensity discharge ballasts shall comply with UL 1029 and, if multiple supply types, with ANSI C82.4. Ballasts shall have minimum ballast factor of 0.9; high power factor; Class A sound rating; and maximum operating case temperature of 25 degrees C above ambient.

(1) Electronic high intensity discharge ballasts shall be constant wattage autotransformer type; shall have less than 10% ballast loss; shall have total harmonic distortion between 10 and 20%; and shall have a minimum starting temperature of -18 degrees C .

(2) Magnetic high intensity discharge ballasts shall have a minimum starting temperature of -29 degrees C .

2.12.3 Fixtures

Fixtures shall be in accordance with the size, shape, appearance, finish, and performance shown. Unless otherwise indicated, lighting fixtures shall be provided with housings, junction boxes, wiring, lampholders, mounting supports, trim, hardware and accessories for a complete and operable installation. Recessed housings shall be minimum 20 gauge cold rolled or galvanized steel as shown. Extruded aluminum fixtures shall have minimum wall thickness of 3 mm . Plastic lenses shall be 100% virgin acrylic or as shown. Glass lenses shall be tempered. Heat resistant glass shall be borosilicate type. Conoid recessed reflector cones shall be Alzak with clear specular low iridescent finish.

- a. Incandescent fixtures shall comply with UL 1571. Incandescent fixture specular reflector cone trims shall be integral to the cone and shall be finished to match. Painted trim finishes shall be white with minimum reflectance of 88%. Low voltage incandescent fixtures shall have integral step-down transformers.
- b. Fluorescent fixtures shall comply with UL 1570. Recessed ceiling fixtures shall comply with NEMA LE 4. Fixtures shall be plainly marked for proper lamp and ballast type to identify lamp diameter, wattage, color and start type. Marking shall be readily visible to service personnel, but not visible from normal viewing angles. Fluorescent fixture lens frames on recessed and surface mounted troffers shall be one assembly with mitered corners. Parabolic louvers shall have a low iridescent finish and 45 degree cut-off. Louver intersection joints shall be hairline type and shall conceal mounting tabs or other assembly methods. Louvers shall be free from blemishes, lines or defects which distort the visual surface. Integral ballast and wireway compartments shall be easily accessible without the use of special tools. Housings shall be constructed to include grounding necessary to start the lamps. Open fixtures shall be equipped with a sleeve, wire guard, or other positive means to prevent lamps from falling. Medium bi-pin lampholders shall be twist-in type with positive locking position. Long compact fluorescent fixtures and fixtures utilizing U-bend lamps shall have clamps or secondary lampholders to support the free ends of the lamps.
- c. High intensity discharge fixture shall comply with UL 1572. Recessed ceiling fixtures shall comply with NEMA LE 4. Reflectors shall be anodized aluminum. Fixtures for horizontal lamps shall have position oriented lampholders. Lampholders shall be pulse-rated to 5,000 volts. Fixtures indicated as classified or rated for hazardous locations or special service shall be designed and independently tested for the environment in which they are installed. Recessed lens fixtures shall have extruded aluminum lens frames. Ballasts shall be integral to fixtures and shall be accessible without the use of special tools. Remote ballasts shall be encased and potted. Lamps shall be shielded from direct view with a UV absorbing material such as tempered glass, and shall be circuited through a cut-off switch which will shut off

the lamp circuit if the lens is not in place.

- d. Emergency lighting fixtures and accessories shall be constructed and independently tested to meet the requirements of applicable codes. Batteries shall be Nicad or equal with no required maintenance, and shall have a minimum life expectancy of five years and warranty period of three years.

- e. Exit Signs

Exit signs shall be ENERGY STAR compliant, thereby meeting the following requirements. Input power shall be less than 5 watts per face. Letter size and spacing shall adhere to NFPA 101. Luminance contrast shall be greater than 0.8. Average luminance shall be greater than 15 cd/m^2 measured at normal (0 degree) and 45 degree viewing angles. Minimum luminance shall be greater than 8.6 cd/m^2 measured at normal and 45 degree viewing angles. Maximum to minimum luminance shall be less than 20:1 measured at normal and 45 degree viewing angles. The manufacturer warranty for defective parts shall be at least 5 years.

2.12.4 Lampholders, Starters, and Starter Holders

UL 542

2.12.5 Ultrasonic, and Passive Infrared Occupancy Sensors

UL 916

2.13 LOW-VOLTAGE FUSES AND FUSEHOLDERS

2.13.1 Fuses, Low Voltage Cartridge Type

NEMA FU 1.

2.13.2 Fuses, High-Interrupting-Capacity, Current-Limiting Type

Fuses, Class G, J, L and CC shall be in accordance with UL 198C.

2.13.3 Fuses, Class K, High-Interrupting-Capacity Type

UL 198D.

2.13.4 Fuses, Class H

UL 198B.

2.13.5 Fuses, Class R

UL 198E.

2.13.6 Fuses, Class T

UL 198H.

2.13.7 Fuses for Supplementary Overcurrent Protection

UL 198G.

2.13.8 Fuses, D-C for Industrial Use

UL 198L.

2.13.9 Fuseholders

UL 512.

2.14 INSTRUMENTS, ELECTRICAL INDICATING

ANSI C39.1.

2.15 MOTORS, AC, FRACTIONAL AND INTEGRAL

Motors, ac, fractional and integral kilowatt, 373.0 kW and smaller shall conform to NEMA MG 1 and UL 1004 for motors; NEMA MG 10 for energy management selection of polyphase motors; and UL 674 for use of motors in hazardous (classified) locations. In addition to the standards listed above, motors shall be provided with efficiencies as specified in the table "MINIMUM NOMINAL EFFICIENCIES" below.

2.15.1 Rating

The kilowatt rating of motors should be limited to no more than 125 percent of the maximum load being served unless a NEMA standard size does not fall within this range. In this case, the next larger NEMA standard motor size should be used.

2.15.2 Motor Efficiencies

All permanently wired polyphase motors of 746 W or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 746 W or more with open, drip proof or totally enclosed fan cooled enclosures shall be high efficiency type, unless otherwise indicated. Motor efficiencies indicated in the tables apply to general-purpose, single-speed, polyphase induction motors. Applications which require definite purpose, special purpose, special frame, or special mounted polyphase induction motors are excluded from these efficiency requirements. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

MINIMUM NOMINAL MOTOR EFFICIENCIES
OPEN DRIP PROOF MOTORS

<u>kW</u>	<u>1200 RPM</u>	<u>1800 RPM</u>	<u>3600 RPM</u>
0.746	82.5	85.5	80.0

MINIMUM NOMINAL MOTOR EFFICIENCIES

1.12	86.5	86.5	85.5
1.49	87.5	86.5	86.5
2.24	89.5	89.5	86.5
3.73	89.5	89.5	89.5
5.60	91.7	91.0	89.5
7.46	91.7	91.7	90.2
11.2	92.4	93.0	91.0
14.9	92.4	93.0	92.4
18.7	93.0	93.6	93.0
22.4	93.6	93.6	93.0
29.8	94.1	94.1	93.6
37.3	94.1	94.5	93.6
44.8	95.0	95.0	94.1
56.9	95.0	95.0	94.5
74.6	95.0	95.4	94.5
93.3	95.4	95.4	95.0
112.0	95.8	95.8	95.4
149.0	95.4	95.8	95.4
187.0	95.4	96.2	95.8
224.0	95.4	95.0	95.4
261.0	94.5	95.4	95.0
298.0	94.1	95.8	95.0
336.0	94.5	95.4	95.4
373.0	94.5	94.5	94.5

TOTALLY ENCLOSED FAN-COOLED MOTORS

<u>kW</u>	<u>1200 RPM</u>	<u>1800 RPM</u>	<u>3600 RPM</u>
0.746	82.5	85.5	78.5
1.12	87.5	86.5	85.5
1.49	88.5	86.5	86.5
2.24	89.5	89.5	88.5
3.73	89.5	89.5	89.5
5.60	91.7	91.7	91.0
7.46	91.7	91.7	91.7
11.2	92.4	92.4	91.7
14.9	92.4	93.0	92.4
18.7	93.0	93.6	93.0
22.4	93.6	93.6	93.0
29.8	94.1	94.1	93.6
37.3	94.1	94.5	94.1
44.8	94.5	95.0	94.1
56.9	95.0	95.4	94.5
74.6	95.4	95.4	95.0
93.3	95.4	95.4	95.4
112.0	95.8	95.8	95.4
149.0	95.8	96.2	95.8
187.0	95.6	96.2	95.9
224.0	95.4	96.1	95.8
261.0	94.5	96.2	94.8
298.0	94.5	95.8	94.5
336.0	94.5	94.5	94.5

TOTALLY ENCLOSED FAN-COOLED MOTORS			
373.0	94.5	94.5	94.5

MINIMUM NOMINAL MOTOR EFFICIENCIES
OPEN DRIP PROOF MOTORS

HP	1200 RPM	1800 RPM	3600 RPM
1	82.5	85.5	80.0
1.5	86.5	86.5	85.5
2	87.5	86.5	86.5
3	89.5	89.5	86.5
5	89.5	89.5	89.5
7.5	91.7	91.0	89.5
10	91.7	91.7	90.2
15	92.4	93.0	91.0
20	92.4	93.0	92.4
25	93.0	93.6	93.0
30	93.6	93.6	93.0
40	94.1	94.1	93.6
50	94.1	94.5	93.6
60	95.0	95.0	94.1
75	95.0	95.0	94.5
100	95.0	95.4	94.5
125	95.4	95.4	95.0
150	95.8	95.8	95.4
200	95.4	95.8	95.4
250	95.4	96.2	95.8
300	95.4	95.0	95.4
350	94.5	95.4	95.0
400	94.1	95.8	95.0
450	94.5	95.4	95.4
500	94.5	94.5	94.5

TOTALLY ENCLOSED FAN-COOLED MOTORS

HP	1200 RPM	1800 RPM	3600 RPM
1	82.5	85.5	78.5
1.5	87.5	86.5	85.5
2	88.5	86.5	86.5
3	89.5	89.5	88.5
5	89.5	89.5	89.5
7.5	91.7	91.7	91.0
10	91.7	91.7	91.7
15	92.4	92.4	91.7
20	92.4	93.0	92.4
25	93.0	93.6	93.0
30	93.6	93.6	93.0
40	94.1	94.1	93.6
50	94.1	94.5	94.1
60	94.5	95.0	94.1
75	95.0	95.4	94.5
100	95.4	95.4	95.0

TOTALLY ENCLOSED FAN-COOLED MOTORS			
125	95.4	95.4	95.4
150	95.8	95.8	95.4
200	95.8	96.2	95.8
250	95.6	96.2	95.9
300	95.4	96.1	95.8
350	94.5	96.2	94.8
400	94.5	95.8	94.5
450	94.5	94.5	94.5
500	94.5	94.5	94.5

2.16 MOTOR CONTROLS AND MOTOR CONTROL CENTERS

2.16.1 General

NEMA ICS 1, NEMA ICS 2, NEMA ICS 3 and NEMA ICS 6, and UL 508 and UL 845. Panelboards supplying non-linear loads shall have neutrals sized for 200 percent of rated current.

2.16.2 Motor Starters

Combination starters shall be provided with circuit breakers, .

2.16.3 Thermal-Overload Protection

Each motor of 93 W (1/8 hp) or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating.

2.16.4 Low-Voltage Motor Overload Relays

2.16.4.1 General

Thermal and magnetic current overload relays shall conform to NEMA ICS 2 and UL 508. Overload protection shall be provided either integral with the motor or motor controller, and shall be rated in accordance with the requirements of NFPA 70. Standard units shall be used for motor starting times up to 7 seconds. Slow units shall be used for motor starting times from 8 to 12 seconds. Quick trip units shall be used on hermetically sealed, submersible pumps, and similar motors.

2.16.4.2 Construction

Manual reset type thermal relay shall be bimetallic construction. Automatic reset type thermal relays shall be bimetallic construction. Magnetic current relays shall consist of a contact mechanism and a dash pot mounted on a common frame.

2.16.4.3 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. Trip current ratings shall be established by selection of the replaceable overload device and shall not be adjustable. Where the controller is remotely-located or difficult to reach, an automatic reset, non-compensated overload relay shall be provided. Manual reset overload relays shall be provided otherwise, and at all locations where automatic starting is provided. Where the motor is located in a constant ambient temperature, and the thermal device is located in an ambient temperature that regularly varies by more than minus 10 degrees C, an ambient temperature-compensated overload relay shall be provided.

2.16.5 Automatic Control Devices

2.16.5.1 Direct Control

Automatic control devices (such as thermostats, float or pressure switches) which control the starting and stopping of motors directly shall be designed for that purpose and have an adequate kilowatt rating.

2.16.5.2 Pilot-Relay Control

Where the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit.

2.16.5.3 Manual/Automatic Selection

- a. Where combination manual and automatic control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch (marked MANUAL-OFF-AUTOMATIC) shall be provided for the manual control.
- b. Where combination manual and automatic control is specified and the automatic-control device actuates the pilot control circuit of a magnetic starter, the magnetic starter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC.
- c. Connections to the selector switch shall be such that; only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low-or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

2.17 PANELBOARDS

Dead-front construction, NEMA PB 1 and UL 67.

2.18 RECEPTACLES

2.18.1 Heavy Duty Grade

NEMA WD 1. Devices shall conform to all requirements for heavy duty receptacles.

2.18.2 Ground Fault Interrupters

UL 943, Class A or B.

2.18.3 NEMA Standard Receptacle Configurations

NEMA WD 6.

a. Single and Duplex, 15-Ampere and 20-Ampere, 125 Volt

15-ampere, non-locking: NEMA type 5-15R, locking: NEMA type L5-15R,
20-ampere, non-locking: NEMA type 5-20R, locking: NEMA type L5-20R.

b. 15-Ampere, 250 Volt

Two-pole, 3-wire grounding, non-locking: NEMA type 6-15R, locking: NEMA type L6-15R. Three-pole, 4-wire grounding, non-locking: NEMA type 15-15R, locking: NEMA type L15-15R.

c. 20-Ampere, 250 Volt

Two-pole, 3-wire grounding, non-locking: NEMA type 6-20R, locking: NEMA type L6-20R. Three-pole, 4-wire grounding, non-locking: NEMA type 15-20R, locking: NEMA type L15-20R.

d. 30-Ampere, 125/250 Volt

Three-pole, 3-wire, non-locking: NEMA type 10-30R, locking: NEMA type L10-30R. Three-pole, 4-wire grounding, non-locking: NEMA type 14-30R, locking: NEMA type L14-30R.

e. 30-Ampere, 250 Volt

Two-pole, 3-wire grounding, non-locking: NEMA type 6-30R, locking: NEMA type L6-30R. Three-pole, 4-wire grounding, non-locking: NEMA type 15-30R, locking: NEMA type L15-30R.

f. 50-Ampere, 125/250 Volt

Three-pole, 3-wire: NEMA type 10-50R. Three-pole, 4-wire grounding: NEMA type 14-50R.

g. 50-Ampere, 250 Volt

Two-pole, 3-wire grounding: NEMA type 6-50R. Three-pole, 4-wire grounding: NEMA type 15-50R.

2.19 Service Entrance Equipment

UL 869A.

2.20 SPLICE, CONDUCTOR

UL 486C.

2.21 SNAP SWITCHES

UL 20.

2.22 TAPES

2.22.1 Plastic Tape

UL 510.

2.22.2 Rubber Tape

UL 510.

2.23 COORDINATED POWER SYSTEM PROTECTION

Analyses shall be prepared to demonstrate that the equipment and system constructed meet the specified requirements for equipment ratings, coordination, and protection. They shall include a load flow analysis, a fault current analysis, and protective device coordination study. The studies shall be performed by a registered professional engineer with demonstrated experience in power system coordination in the last three years. The Contractor shall provide a list of references complete with points of contact, addresses and telephone numbers. The selection of the engineer is subject to the approval of the Contracting Officer.

2.23.1 Scope of Analyses

The fault current analysis, and protective device coordination study shall begin at: the source bus and extend down to system buses where fault availability is 10,000 amperes (symmetrical) for building/facility 600 volt level distribution buses

2.23.2 Determination of Facts

The time-current characteristics, features, and nameplate data for each existing protective device shall be determined and documented. The Contractor shall coordinate with the Base for fault current availability at the site.

2.23.3 Single Line Diagram

A single line diagram shall be prepared to show the electrical system buses, devices, transformation points, and all sources of fault current (including generator and motor contributions). A fault-impedance diagram or a computer analysis diagram may be provided. Each bus, device or transformation point shall have a unique identifier. If a fault-impedance diagram is provide, impedance data shall be shown. Locations of switches, breakers, and circuit interrupting devices shall be shown on the diagram together with available fault data, and the device interrupting rating.

2.23.4 Fault Current Analysis

2.23.4.1 Method

The fault current analysis shall be performed in accordance with methods described in IEEE Std 242, and IEEE Std 399.

2.23.4.2 Data

Actual data shall be utilized in fault calculations. Bus characteristics and transformer impedances shall be those proposed. Data shall be documented in the report.

2.23.4.3 Fault Current Availability

Balanced three-phase fault, bolted line-to-line fault, and line-to-ground fault current values shall be provided at each voltage transformation point and at each power distribution bus. The maximum and minimum values of fault available at each location shall be shown in tabular form on the diagram or in the report.

2.23.5 Coordination Study

The study shall demonstrate that the maximum possible degree of selectivity has been obtained between devices specified, consistent with protection of equipment and conductors from damage from overloads and fault conditions. The study shall include a description of the coordination of the protective devices in this project. Provide a written narrative that describes: which devices may operate in the event of a fault at each bus; the logic used to arrive at device ratings and settings; situation where system coordination is not achievable due to device limitations (an analysis of any device curves which order overlap); coordination between upstream and downstream devices; and relay settings. Recommendations to improve or enhance system reliability, and detail where such changes would involve additions or modifications to the contract and cost changes (addition or reduction) shall be provided. Composite coordination plots shall be provided on log-log graph paper.

2.23.6 Study Report

- a. The report shall include a narrative: the analyses performed; the bases and methods used; and the desired method of coordinated protection of the power system.

- b. The study shall include descriptive and technical data for existing devices and new protective devices proposed. The data shall include manufacturers published data, nameplate data, and definition of the fixed or adjustable features of the existing or new protective devices.
- c. The report shall document utility company data including system voltages, fault MVA, system X/R ratio, time-current characteristic curves, current transformer ratios, and relay device curves and protective device ratings and settings.
- d. The report shall contain fully coordinated composite time-current characteristic curves for each bus in the system, as required to ensure coordinated power system protection between protective devices or equipment. The report shall include recommended ratings and settings of all protective devices in tabulated form.
- e. The report shall provide the calculations performed for the analyses, including computer analysis programs utilized. The name of the software package, developer, and version number shall be provided.

PART 3 EXECUTION

3.1 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following specifications.

3.1.1 Ground Rods

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, additional rods not less than 1.8 meters on centers, may be coupled and driven with the first rod. In high-ground-resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

3.1.2 Ground Bus

Ground bus shall be provided in the electrical equipment rooms as indicated. Noncurrent-carrying metal parts of transformer neutrals and other electrical equipment shall be effectively grounded by bonding to the ground bus. The ground bus shall be bonded to both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 100 mm above the floor. Connections and splices shall be of the brazed, welded, bolted, or pressure-connector type, except that pressure connectors or bolted connections shall be used for connections to removable equipment. For raised floor equipment rooms in

computer and data processing centers, a minimum of 4, one at each corner, multiple grounding systems shall be furnished. Connections shall be bolted type in lieu of thermoweld, so they can be changed as required by additions and/or alterations.

3.1.3 Grounding Conductors

A green equipment grounding conductor, sized in accordance with NFPA 70 shall be provided, regardless of the type of conduit. Equipment grounding bars shall be provided in all panelboards. The equipment grounding conductor shall be carried back to the service entrance grounding connection or separately derived grounding connection. All equipment grounding conductors, including metallic raceway systems used as such, shall be bonded or joined together in each wiring box or equipment enclosure. Metallic raceways and grounding conductors shall be checked to assure that they are wired or bonded into a common junction. Metallic boxes and enclosures, if used, shall also be bonded to these grounding conductors by an approved means per NFPA 70.

3.2 WIRING METHODS

Wiring shall conform to NFPA 70, the contract drawings, and the following specifications. Unless otherwise indicated, wiring shall consist of insulated conductors installed in rigid zinc-coated steel conduit electrical metallic tubing . Where cables and wires are installed in cable trays, they shall be of the type permitted by NFPA 70 for use in such applications. Wire fill in conduits shall be based on NFPA 70 for the type of conduit and wire insulations specified. Wire fill in conduits located in Class I or II hazardous areas shall be limited to 25 percent of the cross sectional area of the conduit.

3.2.1 Conduit and Tubing Systems

Conduit and tubing systems shall be installed as indicated. Conduit sizes shown are based on use of copper conductors with insulation types as described in paragraph WIRING METHODS. Minimum size of raceways shall be 15 mm. Only metal conduits will be permitted when conduits are required for shielding or other special purposes indicated, or when required by conformance to NFPA 70. Nonmetallic conduit and tubing may be used in damp, wet or corrosive locations when permitted by NFPA 70 and the conduit or tubing system is provided with appropriate boxes, covers, clamps, screws or other appropriate type of fittings. Electrical metallic tubing (EMT) may be installed only within buildings. EMT may be installed in concrete and grout in dry locations. EMT installed in concrete or grout shall be provided with concrete tight fittings. EMT shall not be installed in damp or wet locations, or the air space of exterior masonry cavity walls. Bushings, manufactured fittings or boxes providing equivalent means of protection shall be installed on the ends of all conduits and shall be of the insulating type, where required by NFPA 70. Only UL listed adapters shall be used to connect EMT to rigid metal conduit, cast boxes, and conduit bodies. Aluminum conduit may be used only where installed exposed in dry locations. Nonaluminum sleeves shall be used where aluminum conduit passes through concrete floors and firewalls. Penetrations of above grade floor slabs, time-rated partitions and fire walls shall be firestopped in

accordance with Section 07840 FIRESTOPPING. Except as otherwise specified, IMC may be used as an option for rigid steel conduit in areas as permitted by NFPA 70. Raceways shall not be installed under the firepits of boilers and furnaces and shall be kept 150 mm away from parallel runs of flues, steam pipes and hot-water pipes. Raceways shall be concealed within finished walls, ceilings, and floors unless otherwise shown. Raceways crossing structural expansion joints or seismic joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding. Wiring installed in shall be suitable for installation in wet locations.

3.2.1.1 Pull Wires

A pull wire shall be inserted in each empty raceway in which wiring is to be installed if the raceway is more than 15 meters in length and contains more than the equivalent of two 90-degree bends, or where the raceway is more than 45 meters in length. The pull wire shall be of No. 14 AWG zinc-coated steel, or of plastic having not less than 1.4 MPa (200 psi) tensile strength. Not less than 254 mm of slack shall be left at each end of the pull wire.

3.2.1.2 Conduit Stub-Ups

Where conduits are to be stubbed up through concrete floors, a short elbow shall be installed below grade to transition from the horizontal run of conduit to a vertical run. A conduit coupling fitting, threaded on the inside shall be installed, to allow terminating the conduit flush with the finished floor. Wiring shall be extended in rigid threaded conduit to equipment, except that where required, flexible conduit may be used 150 mm above the floor. Empty or spare conduit stub-ups shall be plugged flush with the finished floor with a threaded, recessed plug.

3.2.1.3 Below Slab-on-Grade or in the Ground

Electrical wiring below slab-on-grade shall be protected by a conduit system. Conduit passing vertically through slabs-on-grade shall be rigid steel or IMC. Rigid steel or IMC conduits installed below slab-on-grade or in the earth shall be field wrapped with 0.254 mm thick pipe-wrapping plastic tape applied with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system.

3.2.1.4 Installing in Slabs Including Slabs on Grade

Conduit installed in slabs-on-grade shall be rigid steel or IMC. Conduits shall be installed as close to the middle of concrete slabs as practicable without disturbing the reinforcement. Outside diameter shall not exceed 1/3 of the slab thickness and conduits shall be spaced not closer than 3 diameters on centers except at cabinet locations where the slab thickness shall be increased as approved by the Contracting Officer. Where conduit is run parallel to reinforcing steel, the conduit shall be spaced a minimum of one conduit diameter away but not less than 25.4 mm from the reinforcing steel.

3.2.1.5 Changes in Direction of Runs

Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided where possible. Lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment shall be prevented during the course of construction. Clogged raceways shall be cleared of obstructions or shall be replaced.

3.2.1.6 Supports

Metallic conduits and tubing, and the support system to which they are attached, shall be securely and rigidly fastened in place to prevent vertical and horizontal movement at intervals of not more than 3 meters and within 900 mm of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, beam clamps, or ceiling trapeze. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structure. Loads shall not be applied to joist bridging. Attachment shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. Cutting the main reinforcing bars in reinforced concrete beams or joists shall be avoided when drilling holes for support anchors. Holes drilled for support anchors, but not used, shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Raceways shall not be supported using wire or nylon ties. Raceways shall be independently supported from the structure. Upper raceways shall not be used as a means of support for lower raceways. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Cables and raceways shall not be supported by ceiling grids. Except where permitted by NFPA 70, wiring shall not be supported by ceiling support systems. Conduits shall be fastened to sheet-metal boxes and cabinets with two locknuts where required by NFPA 70, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, a single locknut and bushing may be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered. Additional support for horizontal runs is not required when EMT rests on steel stud cutouts.

3.2.1.7 Exposed Raceways

Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Raceways under raised floors and above accessible ceilings shall be considered as exposed installations in accordance with NFPA 70 definitions.

3.2.1.8 Exposed Risers

Exposed risers in wire shafts of multistory buildings shall be supported by U-clamp hangers at each floor level, and at intervals not to exceed 3 meters.

3.2.1.9 Communications Raceways

Communications raceways indicated shall be installed in accordance with the previous requirements for conduit and tubing and with the additional requirement that no length of run shall exceed 15 meters for 15 mm and 20 mm sizes, and 30 meters for 25 mm or larger sizes, and shall not contain more than two 90-degree bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated. Inside radii of bends in conduits of 25 mm (1 inch) size or larger shall not be less than ten times the nominal diameter.

3.2.2 Busway Systems

Busway systems shall be of the voltage, capacity, and phase characteristics indicated. Vertical runs of busways within 1.8 meters of the floor shall have solid enclosures. Busways shall be supported at intervals not exceeding 1.5 meters, and shall be braced properly to prevent lateral movement. Busways penetrating walls or floors shall be provided with flanges to completely close wall or floor openings.

3.2.3 Cable Trays

Cable trays shall be supported in accordance with the recommendations of the manufacturer but at no more than 1.8 meter intervals. Contact surfaces of aluminum connections shall be coated with an antioxidant compound prior to assembly. Adjacent cable tray sections shall be bonded together by connector plates of an identical type as the cable tray sections. The Contractor shall submit the manufacturer's certification that the cable tray system meets all requirements of Article 318 of NFPA 70.

The cable tray shall be installed and grounded in accordance with the provisions of Article 318 of NFPA 70. Data submitted by the Contractor shall demonstrate that the completed cable tray systems will comply with the specified requirements. Cable trays shall terminate 250 mm from both sides of smoke and fire partitions. Conductors run through smoke and fire partitions shall be installed in 103 mm (4 inch) rigid steel conduits with grounding bushings, extending 300 mm beyond each side of the partitions. The installation shall be sealed to preserve the smoke and fire rating of the partitions. Penetrations shall be firestopped in accordance with Section 07840 FIRESTOPPING.

3.2.4 Cables and Conductors

Installation shall conform to the requirements of NFPA 70. Covered, bare or insulated conductors of circuits rated over 600 volts shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 600 volts or less.

3.2.4.1 Sizing

Unless otherwise noted, all sizes are based on copper conductors and the insulation types indicated. Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than 30 meters long and of 277 volts more than 70 meters long, from panel to load center, shall be no smaller than No. 10 AWG. Class 1 remote control and signal circuit conductors shall be not less than No. 14 AWG. Class 2 remote control and signal circuit conductors shall be not less than No. 16 AWG. Class 3 low-energy, remote-control and signal circuits shall be not less than No. 22 AWG.

3.2.4.2 Use of Aluminum Conductors in Lieu of Copper

Aluminum conductors shall not be used.

3.2.4.3 Cable Systems

Cable systems shall be installed where indicated. Cables shall be installed concealed behind ceiling or wall finish where practicable. Cables shall be threaded through holes bored on the approximate centerline of wood members; notching of surfaces will not be permitted. Sleeves shall be provided through bond beams of masonry-block walls for threading cables through hollow spaces. Exposed cables shall be installed parallel or at right angles to walls or structural members. In rooms or areas not provided with ceiling or wall finish, cables and outlets shall be installed so that a room finish may be applied in the future without disturbing the cables or resetting the boxes. Exposed nonmetallic-sheathed cables less than 1.2 meters above floors shall be protected from mechanical injury by installation in conduit or tubing.

3.2.4.4 Mineral-Insulated Cable

Mineral-insulated, metal-sheathed cable system, Type MI, may be used in lieu of exposed conduit and wiring. Conductor sizes shall be not less than those indicated for the conduit installation. Cables shall be fastened within 300 mm of each turn or offset and at intervals of not more than 1.8 meters. Cable terminations shall be made in accordance with manufacturer's recommendations.

3.2.4.5 Cable Splicing

Splices shall be made in an accessible location. Crimping tools and dies shall be approved by the connector manufacturer for use with the type of connector and conductor.

- a. Copper Conductors, 600 Volt and Under: Splices in conductors No. 10 AWG and smaller diameter shall be made with an insulated, pressure-type connector. Splices in conductors No. 8 AWG and larger diameter shall be made with a solderless connector and insulated with tape or heat-shrink type insulating material equivalent to the conductor insulation.
- b. Aluminum Conductors, 600 Volt and Under: Splices of aluminum

conductors shall be made with a UL listed, solderless, compression-type, aluminum bodied connector, stamped for AL or AL/CU. Aluminum contact surfaces of conductors shall be cleaned with a wire brush and covered with anti-oxidant joint compound prior to making of connections. Any excess joint compound shall be wiped away after installing the connector. Insulate the connection with tape or heat-shrink type insulating material equivalent to the conductor insulation.

- c. Greater Than 600 Volt: Cable splices shall be made in accordance with the cable manufacturer's recommendations.

3.2.4.6 Conductor Identification and Tagging

Power, control, and signal circuit conductor identification shall be provided within each enclosure where a tap, splice, or termination is made.

Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation. Phase conductors of low voltage power circuits shall be identified by color coding. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions.

- a. Color coding shall be provided for service, feeder, branch, and ground conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in the same raceway or box, other neutral shall be white with colored (not green) stripe. The color coding for 3-phase and single-phase low voltage systems shall be as follows:

120/208-volt, 3-phase: Black(A), red(B), and blue(C).
277/480-volt, 3-phase: Brown(A), orange(B), and yellow(C).
120/240-volt, 1-phase: Black and red.

- b. Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by the use of half-lapped bands of colored electrical tape wrapped around the insulation for a minimum of 75 mm of length near the end, or other method as submitted by the Contractor and approved by the Contracting Officer.
- c. Control and signal circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.

3.3 BOXES AND SUPPORTS

Boxes shall be provided in the wiring or raceway systems where required by NFPA 70 for pulling of wires, making connections, and mounting of devices or fixtures. Pull boxes shall be furnished with screw-fastened covers. Indicated elevations are approximate, except where minimum mounting heights for hazardous areas are required by NFPA 70. Unless otherwise indicated, boxes for wall switches shall be mounted 1.2 meters above finished floors.

Switch and outlet boxes located on opposite sides of fire rated walls shall be separated by a minimum horizontal distance of 600 mm. The total combined area of all box openings in fire rated walls shall not exceed 0.0645 square meters per 9.3 square meters. Maximum box areas for individual boxes in fire rated walls vary with the manufacturer and shall not exceed the maximum specified for that box in UL Elec Const Dir. Only boxes listed in UL Elec Const Dir shall be used in fire rated walls.

3.3.1 Box Applications

Each box shall have not less than the volume required by NFPA 70 for number of conductors enclosed in box. Boxes for metallic raceways shall be listed for the intended use when located in normally wet locations, when flush or surface mounted on outside of exterior surfaces, or when located in hazardous areas. Boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed. Boxes for mounting lighting fixtures shall be not less than 102 mm square, or octagonal, except smaller boxes may be installed as required by fixture configuration, as approved. Cast-metal boxes with 2.4 mm wall thickness are acceptable. Large size boxes shall be NEMA 1 or as shown. Boxes in other locations shall be sheet steel except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit and tubing or nonmetallic sheathed cable system, when permitted by NFPA 70. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers.

3.3.2 Brackets and Fasteners

Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and metal expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screw or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts, or nail-type nylon anchors may be used in lieu of expansion shields, or machine screws. Penetration of more than 38.1 mm (1-1/2 inches) into reinforced-concrete beams or more than 19.1 mm (3/4 inch) into reinforced-concrete joists shall avoid cutting any main reinforcing steel. The use of brackets which depend on gypsum wallboard or plasterboard for primary support will not be permitted. In partitions of light steel construction, bar hangers with 25 mm long studs, mounted between metal wall studs or metal box mounting brackets shall be used to secure boxes to the building structure. When metal box mounting brackets are used, additional box support shall be provided on the side of the box opposite the brackets. This additional box support shall consist of a minimum 300 mm long section of wall stud, bracketed to the opposite side of the box and secured by two screws through

the wallboard on each side of the stud. Metal screws may be used in lieu of the metal box mounting brackets.

3.3.3 Mounting in Walls, Ceilings, or Recessed Locations

In walls or ceilings of concrete, tile, or other non-combustible material, boxes shall be installed so that the edge of the box is not recessed more than 6 mm from the finished surface. Boxes mounted in combustible walls or ceiling material shall be mounted flush with the finished surface. The use of gypsum or plasterboard as a means of supporting boxes will not be permitted. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers, as required. The bottom of boxes installed in masonry-block walls for concealed wiring shall be mounted flush with the top of a block to minimize cutting of the blocks, and boxes shall be located horizontally to avoid cutting webs of block. Separate boxes shall be provided for flush or recessed fixtures when required by the fixture terminal operating temperature, and fixtures shall be readily removable for access to the boxes unless ceiling access panels are provided.

3.3.4 Installation in Overhead Spaces

In open overhead spaces, cast-metal boxes threaded to raceways need not be separately supported except where used for fixture support; cast-metal boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers. Hangers shall not be fastened to or supported from joist bridging. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved type fastener not more than 600 mm from the box.

3.4 DEVICE PLATES

One-piece type device plates shall be provided for all outlets and fittings. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel, cast-metal, or impact resistant plastic having rounded or beveled edges. Plates on finished walls shall be of satin finish corrosion resistant steel or satin finish chromium plated brass. Screws shall be of metal with countersunk heads, in a color to match the finish of the plate. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1.6 mm. The use of sectional-type device plates will not be permitted. Plates installed in wet locations shall be gasketed and provided with a hinged, gasketed cover, unless otherwise specified.

3.5 RECEPTACLES

3.5.1 Single and Duplex, 15 or 20-ampere, 125 volt

Single and duplex receptacles shall be rated 20 amperes, 125 volts, two-pole, three-wire, grounding type with polarized parallel slots. Bodies shall be of ivory to match color of switch handles in the same room or to

harmonize with the color of the respective wall, and supported by mounting strap having plaster ears. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacle shall be side- or back-wired with two screws per terminal. The third grounding pole shall be connected to the metal mounting yoke. Switched receptacles shall be the same as other receptacles specified except that the ungrounded pole of each suitable receptacle shall be provided with a separate terminal. Only the top receptacle of a duplex receptacle shall be wired for switching application. Receptacles with ground fault circuit interrupters shall have the current rating as indicated, and shall be UL Class A type unless otherwise shown. Ground fault circuit protection shall be provided as required by NFPA 70 and as indicated on the drawings.

3.5.2 Clock Outlet

Clock outlet, for use in other than a wired clock system, shall consist of an outlet box, a plaster cover where required, and a single receptacle with clock-outlet plate. The receptacle shall be recessed sufficiently within the box to allow the complete insertion of a standard cap, flush with the plate. A suitable clip or support for hanging the clock shall be secured to the top of the plate. Material and finish of the plate shall be as specified in paragraph DEVICE PLATES.

3.5.3 Weatherproof Applications

Weatherproof receptacles shall be suitable for the environment, damp or wet as applicable, and the housings shall be labeled to identify the allowable use. Receptacles shall be marked in accordance with UL 514A for the type of use indicated; "Damp locations", "Wet Locations", "Wet Location Only When Cover Closed". Assemblies shall be installed in accordance with the manufacturer's recommendations.

3.5.3.1 Damp Locations

Receptacles in damp locations shall be mounted in an outlet box with a gasketed, weatherproof, cast-metal cover plate (device plate, box cover) and a gasketed cap (hood, receptacle cover) over each receptacle opening. The cap shall be either a screw-on type permanently attached to the cover plate by a short length of bead chain or shall be a flap type attached to the cover with a spring loaded hinge.

3.5.3.2 Wet Locations

Receptacles in wet locations shall be installed in an assembly rated for such use whether the plug is inserted or withdrawn, unless otherwise indicated. In a duplex installation, the receptacle cover shall be configured to shield the connections whether one or both receptacles are in use. Assemblies which utilize a self-sealing boot or gasket to maintain wet location rating shall be furnished with a compatible plug at each receptacle location and a sign notifying the user that only plugs intended for use with the sealing boot shall be connected during wet conditions.

3.5.4 Receptacles, 15-Ampere, 250-Volt

Receptacles, 15-ampere, 250-volt, shall be single two-pole, three-wire, grounding type with bodies of ivory phenolic compound supported by mounting yoke having plaster ears. The third grounding pole shall be connected to the metal yoke. Each receptacle shall be provided with a mating cord-grip plug.

3.5.5 Receptacles, 20-Ampere, 250-Volt

Receptacles, single, 20-ampere, 250-volt, shall be ivory molded plastic, two-pole, three-wire or three-pole, four-wire, grounding type complete with appropriate mating cord-grip plug.

3.5.6 Receptacles, 30-Ampere, 125/250-Volt

Receptacles, single, 30-ampere, 125/250-volt, shall be molded-plastic, three-pole, four-wire, grounding type, complete with appropriate mating cord-grip type attachment plug. Each dryer receptacle shall be furnished with a non-detachable power supply cord for connection to the electric clothes dryer. The cord shall be an angle-type 900 mm length of dryer cable with three No. 10 AWG conductors.

3.5.7 Receptacles, 30-Ampere, 250-Volt

Receptacles, single, 30-ampere, 250-volt, shall be molded-plastic, three-pole, three-wire type, complete with appropriate mating cord-grip plug.

3.5.8 Special-Purpose or Heavy-Duty Receptacles

Special-purpose or heavy-duty receptacles shall be of the type and of ratings and number of poles indicated or required for the anticipated purpose. Contact surfaces may be either round or rectangular. One appropriate straight or angle-type plug shall be furnished with each receptacle. Locking type receptacles, rated 30 amperes or less, shall be locked by rotating the plug. Locking type receptacles, rated more than 50 amperes, shall utilize a locking ring.

3.6 WALL SWITCHES

Wall switches shall be of the totally enclosed tumbler type. The wall switch handle and switch plate color shall be ivory. Wiring terminals shall be of the screw type or of the solderless pressure type having suitable conductor-release arrangement. Not more than one switch shall be installed in a single-gang position. Switches shall be rated 20-ampere 277-volt for use on alternating current only. Pilot lights indicated shall consist of yoke-mounted candelabra-base sockets rated at 75 watts, 125 volts, and fitted with glass or plastic jewels. A clear 6-watt lamp shall be furnished and installed in each pilot switch. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be red. Dimming switches shall be solid-state flush mounted, sized for the loads.

3.7 SERVICE EQUIPMENT

Service-disconnecting means shall be of the enclosed molded-case circuit breaker type with an external handle for manual operation. When service disconnecting means is a part of an assembly, the assembly shall be listed as suitable for service entrance equipment. Enclosures shall be sheet metal with hinged cover for surface mounting unless otherwise indicated.

3.8 PANELBOARDS AND LOADCENTERS

Circuit breakers and switches used as a motor disconnecting means shall be capable of being locked in the open position. Door locks shall be keyed alike. Nameplates shall be as approved. Directories shall be typed to indicate loads served by each circuit and mounted in a holder behind a clear protective covering. Busses shall be copper .

3.8.1 Loadcenters

Loadcenters shall be circuit breaker equipped.

3.8.2 Panelboards

Panelboards shall be circuit breaker or fusible switch equipped as indicated on the drawings.

3.9 FUSES

Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilize fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics required for effective power system coordination. Time-delay and non-time-delay options shall be as specified.

3.9.1 Cartridge Fuses; Noncurrent-Limiting Type

Cartridge fuses of the noncurrent-limiting type shall be Class H, nonrenewable, dual element, time lag type and shall have interrupting capacity of 10,000 amperes. At 500 percent current, cartridge fuses shall not blow in less than 10 seconds.

3.9.2 Cartridge Fuses; Current-Limiting Type

Cartridge fuses, current-limiting type, Class RK1 shall have tested interrupting capacity not less than 100,000 amperes. Fuse holders shall be the type that will reject all Class H fuses.

3.9.3 Motor and Transformer Circuit Fuses

Motor, motor controller, transformer, and inductive circuit fuses shall be

Class RK1 or RK5, current-limiting, time-delay with 200,000 amperes interrupting capacity.

3.10 MOTORS

Each motor shall conform to the kW and voltage ratings indicated, and shall have a service factor and other characteristics that are essential to the proper application and performance of the motors under conditions shown or specified. Three-phase motors for use on 3-phase 208-volt systems shall have a nameplate rating of 200 volts. Unless otherwise specified, all motors shall have open frames, and continuous-duty classification based on a 40 degree C ambient temperature reference. Polyphase motors shall be squirrel-cage type, having normal-starting-torque and low-starting-current characteristics, unless other characteristics are specified in other sections of these specifications or shown on contract drawings. The Contractor shall be responsible for selecting the actual kilowatt (horsepower) ratings and other motor requirements necessary for the applications indicated. When electrically driven equipment furnished under other sections of these specifications materially differs from the design, the Contractor shall make the necessary adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed.

3.11 MOTOR CONTROL

Each motor or group of motors requiring a single control and not controlled from a motor-control center shall be provided under other sections of these specifications with a suitable controller and devices that will perform the functions as specified for the respective motors. Each motor of 93 W (1/8 hp) or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating. Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motors directly, provided the devices used are designed for that purpose and have an adequate kilowatt rating. When the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit. When combination manual and automatic control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch shall be provided for the manual control; when the automatic-control device actuates the pilot control circuit of a magnetic starter, the latter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low- or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic

positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

3.11.1 Contacts

Unless otherwise indicated, contacts in miscellaneous control devices such as float switches, pressure switches, and auxiliary relays shall have current and voltage ratings in accordance with NEMA ICS 2 for rating designation B300.

3.11.2 Safety Controls

Safety controls for boilers shall be connected to a 2-wire, 120 volt grounded circuit supplied from the associated boiler-equipment circuit. Where the boiler circuit is more than 120 volts to ground, safety controls shall be energized through a two-winding transformer having its 120 volt secondary winding grounded. Overcurrent protection shall be provided in the ungrounded secondary conductor and shall be sized for the load encountered.

3.12 MOTOR-DISCONNECT MEANS

Each motor shall be provided with a disconnecting means when required by NFPA 70 even though not indicated. For single-phase motors, a single or double pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Switches shall disconnect all ungrounded conductors.

3.13 LIGHTING FIXTURES, LAMPS AND BALLASTS

This paragraph shall cover the installation of lamps, lighting fixtures and ballasts in interior or building mounted applications.

3.13.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed just prior to project completion. Lamps installed and used for working light during construction shall be replaced prior to turnover to the Government if more than 15% of their rated life has been used. Lamps shall be tested for proper operation prior to turn-over and shall be replaced if necessary with new lamps from the original manufacturer. 10% spare lamps of each type, from the original manufacturer, shall be provided.

3.13.2 Lighting Fixtures

Fixtures shall be as shown and shall conform to the following specifications and shall be as detailed on the drawings. Illustrations shown on the drawings are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular

manufacturer. Fixtures of similar designs and equivalent energy efficiency, light distribution and brightness characteristics, and of equal finish and quality will be acceptable if approved. In suspended acoustical ceilings with fluorescent fixtures, the fluorescent emergency light fixtures shall be furnished with self-contained battery packs.

3.13.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

3.13.2.2 Ceiling Fixtures

Ceiling fixtures shall be coordinated with and suitable for installation in, on or from the ceiling as shown. Installation and support of fixtures shall be in accordance with NFPA 70 and manufacturer's recommendations. Where seismic requirements are specified herein, fixtures shall be supported as shown or specified. Recessed fixtures shall have adjustable fittings to permit alignment with ceiling panels. Recessed fixtures installed in fire-resistive ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling, in conformance with UL Elec Const Dir. Surface-mounted fixtures shall be suitable for fastening to the ceiling panel structural supports.

3.13.2.3 Fixtures for Installation in Grid Type Ceilings

Fixtures for installation in grid type ceilings which are smaller than a full tile shall be centered in the tile. 305 by 1219 mm fixtures shall be mounted along the grid rail as shown. Work above the ceiling shall be coordinated among the trades to provide the lighting layout shown. Fixtures mounted to the grid shall have trim exactly compatible with the grid. Contractor shall coordinate trims with ceiling trades prior to ordering fixtures. Metric fixtures shall be designed to fit the metric grid specified. Fixtures in continuous rows shall be coordinated between trades prior to ordering. Fixtures shall be mounted using independent supports capable of supporting the entire weight of the fixture. No fixture shall rest solely on the ceiling grid. Recessed fixtures installed in seismic areas should be installed utilizing specially designed seismic clips. Junction boxes shall be supported at four points.

3.13.2.4 Suspended Fixtures

Suspended fixtures shall be provided with swivel hangers or hand-straightens so that they hang plumb. Pendants, rods, or chains 1.2 meters or longer excluding fixture shall be braced to prevent swaying using three cables at 120 degrees of separation. Suspended fixtures in continuous rows shall have internal wireway systems for end to end wiring and shall be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces. Aligning splines shall be used on extruded aluminum fixtures to assure hairline joints. Steel fixtures shall be supported to prevent "oil-canning" effects. Fixture finishes shall be free of scratches, nicks, dents, and warps, and shall match the color and gloss specified. Pendants shall be finished to match fixtures. Aircraft cable

shall be stainless steel. Canopies shall be finished to match the ceiling and shall be low profile unless otherwise shown. Maximum distance between suspension points shall be 3.1 meters or as recommended by the manufacturer, whichever is less.

Suspended fixtures installed in seismic areas shall have 45% swivel hangers and shall be located with no obstructions within the 45% range in all directions. The stem, canopy and fixture shall be capable of 45% swing.

3.13.3 Ballasts

Remote type ballasts or transformers, where indicated, shall be mounted in a well ventilated, easily accessible location, within the maximum operating distance from the lamp as designated by the manufacturer.

3.13.4 Emergency Light Sets

Emergency light sets shall conform to UL 924 with the number of heads as indicated. Sets shall be permanently connected to the wiring system by conductors installed in short lengths of flexible conduit.

3.14 BATTERY CHARGERS

Battery chargers shall be installed in conformance with NFPA 70.

3.15 EQUIPMENT CONNECTIONS

Wiring not furnished and installed under other sections of the specifications for the connection of electrical equipment as indicated on the drawings shall be furnished and installed under this section of the specifications. Connections shall comply with the applicable requirements of paragraph WIRING METHODS. Flexible conduits 2 m or less in length shall be provided to all electrical equipment subject to periodic removal, vibration, or movement and for all motors. All motors shall be provided with separate grounding conductors. Liquid-tight conduits shall be used in damp or wet locations.

3.15.1 Motors and Motor Control

Motors, motor controls, and motor control centers shall be installed in accordance with NFPA 70, the manufacturer's recommendations, and as indicated. Wiring shall be extended to motors, motor controls, and motor control centers and terminated.

3.15.2 Installation of Government-Furnished Equipment

Wiring shall be extended to the equipment and terminated.

3.15.3 Food Service Equipment Provided Under Other Sections

Wiring shall be extended to the equipment and terminated.

3.16 CIRCUIT PROTECTIVE DEVICES

The Contractor shall calibrate, adjust, set and test each new adjustable circuit protective device to ensure that they will function properly prior to the initial energization of the new power system under actual operating conditions.

3.17 REPAIR OF EXISTING WORK

The work shall be carefully laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, this work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost to the Government.

3.18 FIELD TESTING

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 10 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspection recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test reports will be signed and dated by the Contractor.

3.18.1 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.18.2 Ground-Resistance Tests

The resistance of each grounding electrode system shall be measured using the fall-of-potential method defined in IEEE Std 81. Soil resistivity in the area of the grid shall be measured concurrently with the grid measurements. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Single rod electrode - 25 ohms.
- b. Grounding electrode system - 25 ohms.

3.18.3 Ground-Grid Connection Inspection

All below-grade ground-grid connections will be visually inspected by the Contracting Officer before backfilling. The Contractor shall notify the Contracting Officer 24 hours before the site is ready for inspection.

3.18.4 Cable Tests

The Contractor shall be responsible for identifying all equipment and devices that could be damaged by application of the test voltage and ensuring that they have been properly disconnected prior to performing insulation resistance testing. An insulation resistance test shall be performed on all low and medium voltage cables after the cables are installed in their final configuration and prior to energization. The test voltage shall be 500 volts DC applied for one minute between each conductor and ground and between all possible combinations of conductors. The minimum value of resistance shall be:

$$R \text{ in megohms} = (\text{rated voltage in kV} + 1) \times 304.8 / (\text{length of cable in meters})$$

Each cable failing this test shall be repaired or replaced. The repaired cable system shall then be retested until failures have been eliminated.

3.18.4.1 Medium Voltage Cable Tests

- a. Continuity test.
- b. Insulation resistance test.
- c. DC high-potential test.

3.18.4.2 Low Voltage Cable Tests

- a. Continuity test.
- b. Insulation resistance test.

3.18.5 Metal Enclosed Bus Duct Tests

- a. Insulation Resistance phase-to-phase, all combinations.
- b. Insulation resistance phase-to-ground, each phase.
- c. AC or DC high-potential test.
- d. Phase rotation test.

3.18.6 Motor Tests

- a. Phase rotation test to ensure proper directions.
- b. Operation and sequence of reduced voltage starters.
- c. High potential test on each winding to ground.

- d. Insulation resistance of each winding to ground.
- e. Vibration test.
- f. Dielectric absorption test on motor and starter.

3.18.7 Circuit Breaker Tests

The following field tests shall be performed on circuit breakers.

3.18.7.1 Circuit Breaker Tests, Medium Voltage

- a. Insulation resistance test phase-to-phase, all combinations.
- b. Insulation resistance tests phase-to-ground, each phase.
- c. Closed breaker contact resistance test.
- d. Power factor test.
- e. High-potential test.
- f. Manual and electrical operation of the breaker.

3.18.7.2 Circuit Breakers, Molded Case

- a. Insulation resistance test phase-to-phase, all combinations.
- b. Insulation resistance test phase-to-ground, each phase.
- c. Closed breaker contact resistance test.
- d. Manual operation of the breaker.

3.18.8 Protective Relays

Protective relays shall be visually and mechanically inspected, adjusted, tested, and calibrated in accordance with the manufacturer's published instructions. These tests shall include pick-up, timing, contact action, restraint, and other aspects necessary to insure proper calibration and operation. Relay settings shall be implemented in accordance with the coordination study. Relay contacts shall be manually or electrically operated to verify that the proper breakers and alarms initiate. Relaying current transformers shall be field tested in accordance with IEEE C57.13.

3.19 OPERATING TESTS

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. An operating test report shall be submitted in accordance with paragraph FIELD TEST REPORTS.

3.20 FIELD SERVICE

3.20.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations. A VHS format video tape or DVD format video disk of the entire training shall be submitted.

3.20.2 Installation Engineer

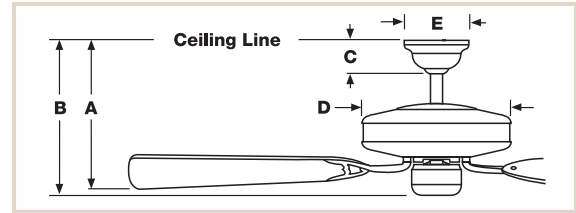
After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of equipment, assist in the performance of the onsite tests, oversee initial operations, and instruct personnel as to the operational and maintenance features of the equipment.

3.21 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

PRODUCT SPECIFICATIONS



L-5

SERIES	Dimensions					Blade Sweep		Blade	Weight	Speed	Power	Motor	Tech [†]	Warranty
	A	B	C	D	E	LONG	SHORT	Pitch	Lbs.	RPM	(watts)	Size		(Motor)
Aegean Classic	16.25	24*	4	15.5	5.6	52"	44"	15°	36	70-215	10-84	188mm x 20mm	V•T / V•T2	Lifetime
Bel Air	9.25	14*	3	12.25	5.6	55"	—	14°	24	25-150	22-110	XLP2000 - 28mm	A•T / I•T / I•T2	Lifetime
Bel Air Halo	13.25	18.5*	3	15.5	5.6	55"	—	14°	24	25-150	22-110	XLP2000 - 28mm	I•T / I•T2	Lifetime
Bella	14.5	17.5*	3	16.1	5.6	52"	44"	15°	30	70-215	10-84	188mm x 20mm	V•T2	Lifetime
Bella Uplight	14.5	16	3	16.1	5.6	52"	44"	15°	27	70-215	10-84	188mm x 20mm	V•T2	Lifetime
Brescia Gallery	11.3	16.5*	3	14	5.6	52"	—	15°	32	35-185	8-108	XLP2000 - 28mm	A•T / I•T / I•T2	Lifetime
Brescia	11.3	12.6	3	14	5.6	52"	44"	15°	27	35-185	8-108	XLP2000 - 28mm	I•T / 3-S / W-52	Lifetime
Campana	12.2	13.5	3	12.4	5.6	53"	45"	16°	22	70-215	10-84	188mm x 20mm	V•T2 / 3-S / W-52	Lifetime
Capistrano	11.1	12.75	3	12.6	5.6	53"	45"	16°	24	70-215	10-84	188mm x 20mm	V•T2 / 3-S / W-52	Lifetime
Cathay	11	16.25*	3	13.9	7.7	56"	—	14°	36	35-160	32-94	XLP2100 - 33mm	I•T	Lifetime
Commodore	15	17.5	3	9	5.6	52"	—	14°	25	40-190	7-110	XLP2000 - 28mm	3-S / W-52	Lifetime
Concentra	11	12.75	3	11.5	5.6	50"	42"	16°	20	45-200	21-86	188mm x 20mm	V•T2 / 3-S / W-52	Lifetime
Estrada	13	13.75	3	12	5.6	52"	44"	15°	25	65-203	21-86	188mm x 20mm	3-S / W-52	30 Years
Four Seasons III	10.75	12.75	3	11.5	5.6	52"	42"	13°	14	50-200	25-80	172mm x 12mm	3-S / W-52	Lifetime
Four Seasons III Hugger	7	8	N/A	11	5.6	52"	42"	13°	11	50-200	25-85	172mm x 12mm	3-S	Lifetime
Four Seasons III Outsider	10.75	12.75	3	11.5	5.6	52"	—	13°	17	50-200	20-80	172mm x 12mm	3-S / W-52	30 Years
Kawayan	17.5	22.2*	3	16	5.6	52"	—	15°	40	70-215	10-84	188mm x 20mm	V•T2	Lifetime
Key Largo	13.3	12.3	3	13.3	5.6	52"	42"	15°	30	70-215	10-84	188mm x 20mm	V•T2	Lifetime
Lanai	11.1	12.75	3	12.6	5.6	53"	45"	16°	25	70-215	10-84	188mm x 20mm	3-S / W-52	30 Years
le Grande	11.96	16.23	3	8.69	5.6	62"	—	14°	27	53-165	14-84	188mm x 20mm	V•T2	Lifetime
Malibu Star	21	23	3	6.25	5.6	84"	—	15°	19	6-45	7-103	XLP2000 - 28mm	3-S / W-80 / W-52	Lifetime
Marrakesh	9.25	14.3	4	19.75	5.6	62"	—	14°	40	53-165	14-84	188mm x 20mm	V•T2	Lifetime
Metropolitan	12	12.2	3	12	5.6	52"	44"	15°	25	35-185	8-108	XLP2000 - 28mm	I•T	Lifetime
Mission Fan	11	15.4*	3	13.9	7.7	56"	—	14°	36	35-160	32-94	XLP2100 - 33mm	I•T	Lifetime
Mission Table Lamp	17 L	17 W	23 H	N/A	N/A	N/A	N/A	N/A	29	N/A	N/A	N/A	N/A	N/A
Mission Floor Lamp	17 L	17 W	66 H	N/A	N/A	N/A	N/A	N/A	49	N/A	N/A	N/A	N/A	N/A
Mission Wall Sconce	14 L	7 W	12 H	N/A	N/A	N/A	N/A	N/A	5	N/A	N/A	N/A	N/A	N/A
Moderne Table Fan	21.1 H	17.6 W	13 D	N/A	N/A	14.5"	N/A	N/A	24	600-1200	58-75	N/A	3-Speeds	Lifetime
New Orleans	26	28	3	13	5.6	54"	46"	15°	36	35-185	8-108	XLP2000 - 28mm	3-S / W-52	Lifetime
19th Century	22	20.5	6.75	10.5	5.6	54"	—	14°	35	40-190	7-110	XLP2000 - 28mm	I•T	Lifetime
Nouvelle	17.9	19.5	4	12.3	5.6	54"	—	14°	36	25-150	32-94	XLP2100 - 33mm	I•T	Lifetime
Panama XLP	10.75	12.75	3	12	5.6	50"	42"	15°	20	40-190	8-108	XLP2000 - 28mm	A•T / I•T / I•T2 / 3-S / W-52	Lifetime
Panama XTR	10.75	12.75	3	12	5.6	50"	42"	20°	27	40-170	14-84	200mm x 20mm	I•T2 / 4-S / W-52	Lifetime
Panama Damp XLP	10.75	12.75	3	12	5.6	50"	42"	15°	20	40-190	8-108	XLP2000 - 28mm	3-S / W-52	30 Years
Panama Damp XTR	10.75	12.75	3	12	5.6	50"	42"	20°	27	40-170	14-84	200mm x 20mm	4-S / W-52	30 Years
S3	9.8	14*	3	10.2	7.7	54"	—	15°	23	50-180	21-86	188mm x 20mm	V•T	Lifetime
Stealth	10.75	13.25*	3	11.5	5.6	53"	—	14°	33	25-200	31-112	XLP2000 - 28mm	A•T / I•T / I•T2	Lifetime
Utopian	10.7	12.22	3	11.2	5.6	50"	40"	16°	25	55-200	7-83	172mm x 20mm	3-S / W-52	30 Years
Ventura	11	12.5	3	10.25	5.6	—	42"	16°	19	63-283	7-106	XLP2000 - 28mm	I•T / 3-S / W-52	Lifetime
Verrazano	22.5	25.5*	3	9.5	7.7	54"	—	14°	32	45-175	11-105	XLP2000 - 28mm	3-S / W-1811 / W-52	Lifetime
Victorian	11.5	13.5	3	13	5.6	54"	46"	15°	23	35-185	8-108	XLP2000 - 28mm	I•T	Lifetime
Wailea	11	11.54	3	9.5	5.6	32"	—	25°	17	90-275	25-80	153mm x 20mm	3-S / W-52	30 Years
Wilderness	16	15.6	3	11.8	5.6	52"	42"	15°	50	70-215	10-84	188mm x 20mm	V•T2	Lifetime
Zephair Table Fan	21 H	17 W	11 D	N/A	N/A	14.5"	N/A	N/A	24	600-1200	58-75	N/A	3-Speeds	Lifetime
Zephair Floor Fan	54 H	18 W	11 D	N/A	N/A	14.5"	N/A	N/A	50	600-1200	58-75	N/A	3-Speeds	Lifetime
Zephair Desk Fan	16.5 H	12.5 W	8 D	N/A	N/A	10.44"	N/A	N/A	20	710-1310	58-75	N/A	3-Speeds	Lifetime

* Dimension B with * = measurement including Light Fixture and Glass.

Dimension B without * = measurement to bottom of Switch Housing.

[†] Tech (Fan Controls): A•T = Advan•Touch V•T = Versa•Touch V•T2 = Versa•Touch 2 I•T = Intelli•Touch 3-S = Three Speed 4-S = Four Speed (W-52 Adapt•Touch Option adds Remote Control Operation)

NOTE: All fans, light fixtures and wall controls are listed by Underwriters Laboratories, and/or Edison Testing Laboratories. All blades must be a minimum of 18" from the wall. In the interest of continual product improvement, we reserve the right to alter details without notice to conform to regulations, availability of materials, improve designs or discontinue models. 120VAC, 60HZ rate 0.9 Amp.

Intended Use

Suitable for accent lighting when more light is needed in a centralized area. Ideal for bathrooms, utility areas and stairwells.

Features

Faux marble or plain white end caps.

Allows for vertical or horizontal mounting.

Diffuser is either white acrylic or clear fluted with white acrylic ends. All models

have one-piece end cap and diffuser.

Spring retention on diffuser.

UL Listed (standard). CSA Certified (consult factory).

Standard with residential grade electronic ballast

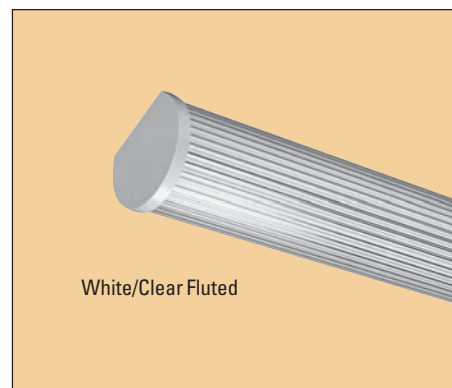
L-3



Black Marble



Solid White



White/Clear Fluted

Vanity Wall Brackets

Narrow Band

Ordering Information

Example: 11928 WH CI

Model number	Ballast	Lamp type ¹	Finish ³	Voltage	Options
<u>Narrow band ends</u> 11928 2-foot unit 11929 3-foot unit 11930 4-foot unit	(blank)	(blank) 17W T8 (24") or 25W T8 (36") or 32W T8 (48")	WH White FMB Black Marble	(blank) 120V 277 277V 347 347V	See page 165 for ballasts and other options and accessories.
<u>White/clear fluted</u> 11931 2-foot unit 11932 3-foot unit 11933 4-foot unit	RE Residential grade electronic T8 (standard). ²				

Availability and Dimensions

Nominal Size	Model Number	Finish	Number of Lamps	Width in.(cm)	Depth in.(cm)	Length in.(cm)
2'	11928 11931	WH, FMB WH	2	4 ¹ / ₈ (10.5)	4 ⁷ / ₈ (12.4)	25 ⁵ / ₈ (65.0)
3'	11929 11932	WH, FMB WH	2	4 ¹ / ₈ (10.5)	4 ⁷ / ₈ (12.4)	25 ⁵ / ₈ (65.0)
4'	11930 11933	WH, FMB WH	2	4 ¹ / ₈ (10.5)	4 ⁷ / ₈ (12.4)	25 ⁵ / ₈ (65.0)

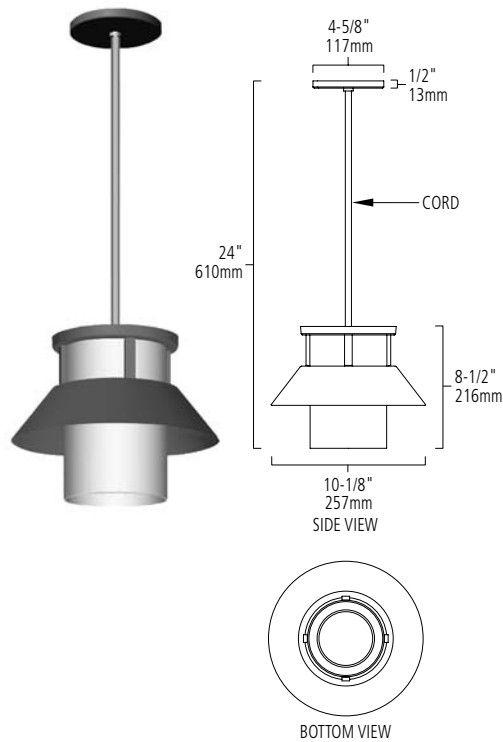
NOTES:

¹ Lamps not included.

² RE fixtures use 32W T8 lamps. No designation for Lamp Type is required in the catalog number.

³ Not available with White Fluted.

FLARE: CP3848



INCANDESCENT CORD SUSPENDED PENDANT

Model ①	Lamping ②	Finish ③	Cord ④
CP3848	50PAR30 50 watt, PAR30 medium base*	BA Brushed Solid Aluminum BB Brushed Solid Brass BU Brushed Solid Copper PT Painted (specify color)	BC Black suspension cord WC White suspension cord

VOLTAGE:
120V

***NOTE:**
Suitable for 60W maximum incandescent lamp:
A19, K19, R20, PAR20, or PAR30

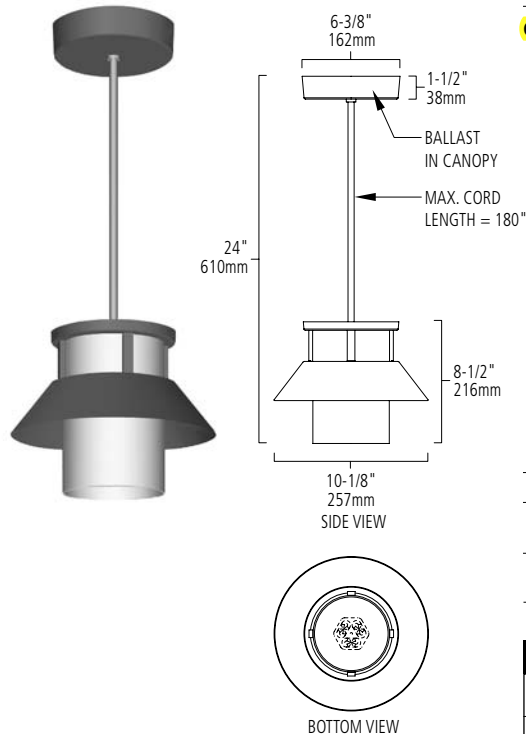
Diffuser	White acrylic.
Painted Finishes	EPA compliant oven-cured low VOC lacquer in 39 standard colors. See 2002/2003 catalog or Materials and Finishes brochure for color selection.
Metal Finishes	Solid aluminum, brass, or copper. See 2002/2003 catalog or Materials and Finishes brochure.
Mounting	Surface mounts to a 4" octagonal electrical junction box (by others).

Sample Catalog Number

CP3848	-	50PAR30(120V)	-	BU	-	WC
① Model		② Lamping (Voltage)		③ Finish		④ Suspension Cord

L-4

FLARE: CP3850



FLUORESCENT CORD SUSPENDED PENDANT

Model ①	Lamping ②	Finish ③	Cord ④
CP3850	1TF26 26 watt triple, 4-pin GX24q-3 base 1TF32 32 watt triple, 4-pin GX24q-3 base 1TF42 42 watt triple, 4-pin GX24q-4 base	BA Brushed Solid Aluminum BB Brushed Solid Brass BU Brushed Solid Copper PT Painted (specify color)	BC Black suspension cord WC White suspension cord

VOLTAGE:
120V
277V

Diffuser	White acrylic.
Ballast	Integral, high power factor, electronic, 120V or 277V, 26, 32, or 42 watt lamp operation.
Painted Finishes	EPA compliant oven-cured low VOC lacquer in 39 standard colors. See 2002/2003 catalog or Materials and Finishes brochure for color selection.
Metal Finishes	Solid aluminum, brass, or copper. See 2002/2003 catalog or Materials and Finishes brochure.
Mounting	Surface mounts to a 4" octagonal electrical junction box (by others).

Sample Catalog Number

CP3850	-	1TF32(120V)	-	BU	-	WC
① Model		② Lamping (Voltage)		③ Finish		④ Suspension Cord



FEATURES & SPECIFICATIONS

INTENDED USE

Recessed housing rated IC or Non-IC. For new construction only.
Approved for all ceiling and wiring types. Sold in resale pack of (6) only.

CONSTRUCTION

Air-Tight standard. Tested to meet current energy codes.
Aluminum housing.
Galvanized steel pan.

Galvanized bar hangers span up to 24" o.c. and feature built in nailer and integral T-bar clips. Two locking screws hold fixture in position.
Galvanized steel junction box with four built-in Romex clamps; five ½" and two ¾" nominal knockouts with slots for pryout. Rated for through branch wiring.

Maximum 4 (2 in, 2 out) No 12 AWG conductors. Rated for 90° C.
Ground wire provided.

Removable J-box doors for easy access.

ELECTRICAL SYSTEM

Durable medium base porcelain socket with nickel plated copper alloy screw shell and contact.

Socket clips to top of housing to prevent paint overspray in socket screw shell.

Socket attaches to reflector to ensure proper and consistent lamp position.

Thermal protection provided against improper lamp usage.

120 volts only.

INSTALLATION

Air-Tight applications (refer to installation instructions for compliance to codes).

2 x 8 wood joist or T-bar installation.

Expandable bar hangers allow for off center mounting in wood joist or T-bar ceilings.

Length of 25¼" maximum 13¼" minimum or cut to fit 9" on center joist construction.

Vertical adjustment of housing allows for flush mounting with ceiling face.

Ceiling cutout 7".

Maximum ceiling adjustment 1".

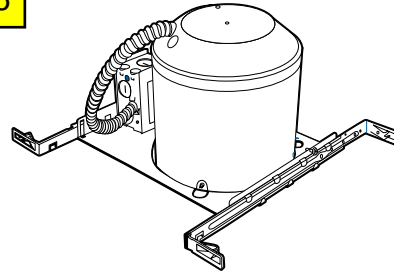
LISTING

U.L. Listed to U.S. and Canadian safety standards.

Damp location listing. (See trim selection for wet location listing).

Catalog Number	
Notes	Type

L-6



6" Housing

L7X

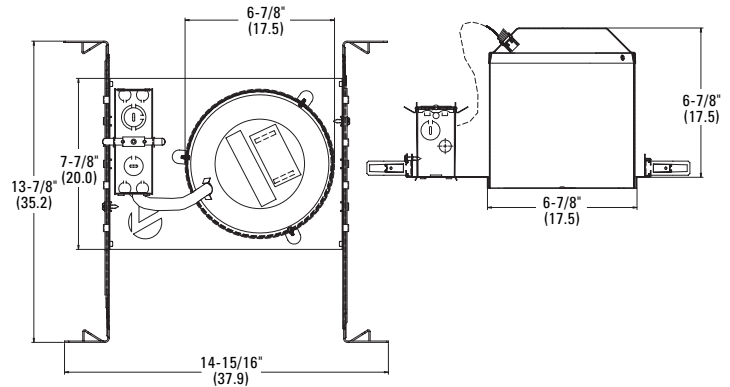
INCANDESCENT
IC/Non-IC
New Construction

Specifications

Height: 6-7/8 (17.48)

Length: 15 (38.1)

Width: 13-7/8 (35.24)



All dimensions are inches (centimeters).

ORDERING INFORMATION

Choose the boldface catalog nomenclature that best suits your needs and write it on the appropriate line. Order accessories as separate catalog number.













Example: **L7X R6**

L7X	
Series	Options
L7X	Shipped installed in fixture PHC Poke-home wire connectors.

NOTE:

See trim summary on reverse side for maximum wattages.

7 & 6 Series 6" Incandescent L7X Full Reflector Trims

Description Catalog number	Maximum wattage Sheet number	Description Catalog number	Maximum wattage Sheet number	Description Catalog number	Maximum wattage Sheet number	Description Catalog number	Maximum wattage Sheet number
General/Task				Accent/Adjustable			
Open Wide Flange 601 601PB White Polished Brass	65 BR30 75 PAR30	Baffle Wide Flange 6B1 6B1W Black 6B1PB White 6B1BL/PB Polished Brass 6B1PB/PB Black/Polished Brass Polished Brass	40 A19 65 BR30 75 PAR30	Eyeball Narrow Flange 6E1 6E1PB White Polished Brass	65 BR30 75 PAR30	Wallwash Narrow Flange 6W1 White	60 A19
IC/Non-IC	ROPN-100			IC/Non-IC	RADJ-100	Non-IC	RWLL-100
Open Narrow Flange 602 602A White 602G Clear Specular 602SA Gold Specular 602SG Clear Diffuse Gold Diffuse	100 A19 120 BR40 150 PAR38	Baffle Narrow Flange 6B2 Black 6B2W White 6B2BL/PB Black/Polished Brass	65 BR30 75 PAR30/38	Baffled Eyeball Narrow Flange 6E2 Black 6E2W White 6E2PB Polished Brass 6E2SB Satin Brass	65 BR30 75 PAR30	Baffled Wallwash Narrow Flange 6W2 Black 6W2W White	100 A19
		IC/Non-IC	RBAF-100	IC/Non-IC	RADJ-110	Non-IC	RWLL-110
Non-IC	ROPN-110			Regressed Eyeball Narrow Flange 6RE1 Black 6RE1W White 6RE1BL/PB Black/Polished Brass 6RE1PB/PB Polished Brass	65 BR30 75 PAR30	Wallwash Narrow Flange 7W1 White	60 A19
Open Narrow Flange 603 603A White 603G Clear Specular Gold Specular	100 A19 120 BR40 150 PAR38	Baffle Narrow Flange 6B3 Black 6B3W White 6B4 Black 6B4W White	100 A19 120 BR40 150 PAR38	IC/Non-IC	RADJ-120	Non-IC	RWLL-140
		Non-IC	RBAF-120	Baffle Regressed Eyeball Narrow Flange 6RE2 Black 6RE2W White 6RE2BL/PB Black/Polished Brass 6RE2PB/PB Polished Brass	65 BR30 75 PAR30	Pinhole Narrow Flange 6S1 White	60 A19 65 BR30 50 R20/PAR20
Non-IC	ROPN-130			IC/Non-IC	RADJ-130	Non-IC	RWLL-130
Open Cone Narrow Flange 6C3A Clear Specular 6C3BL Black Specular 6C3G Gold Specular	100 A19 120 BR40 150 PAR38	Baffle Narrow Flange 7B2 Black 7B2W White	65 BR30 75 PAR30	Eyeball Wide Flange 7E1 White	65 BR30 75 PAR30	Lens/Wet Location	
		IC/Non-IC	RBAF-170	IC/Non-IC	RADJ-160	WETlite™ 6H20 White	75 PAR38
Non-IC	ROPN-140			Regressed Eyeball Wide Flange 7RE1 White	65 BR30 50 PAR30	IC/Non IC	RLNS-115
Open Narrow Flange 702 White 702A Clear Diffuse 702G Gold Diffuse 702AZ Clear Specular 702BLZ Black Specular 702GZ Gold Specular	65 BR30 75 PAR30	Baffle Wide Flange 7B3 Black 7B3W White	65 BR30 75 PAR30	IC/Non-IC	RADJ-170	Shower/Closet Lens Narrow Flange 6LD1 Drop Opal Plastic* 6LD2 Drop Prismatic Plastic* 6LF1 Flush Opal Plastic* 6LF2 Flush Prismatic Plastic*	60 A19
		IC/Non-IC	RBAF-180	Baffle Adjustable Narrow Flange 6AB1 Black 6AB1W White	65 BR30 75 PAR30	Non-IC	RLNS-100
IC/Non-IC	ROPN-180			Non-IC	RADJ-140	Glass Lens Narrow Flange 6LD3 Drop Opal White Splay 6LDB3 Drop Opal Black Baffle 6LF3 Flush White White Splay 6LFB3 Flush White Black Baffle 6L4 Fresnel White Splay 6L4B Fresnel Black Baffle	75 A19
Open Wide Flange 703 White	65 BR30 75 PAR30	Baffle Narrow Flange 7B5 Black 7B5W White	120 BR40 150 PAR38	Cone Adjustable Narrow Flange 6AC1A Clear Specular 6AC1BL Black Specular 6AC1G Gold Specular	65 BR30 75 PAR30	Non-IC	RLNS-100
		Non-IC	RBAF-190	IC/Non-IC	RADJ-140	Shower/Closet Lens Narrow Flange 7LD1 Drop Opal Metal Flange 7LD1PF Drop Opal Plastic* 7LD2PF Drop Prismatic Plastic*	40 A19
IC/Non-IC	ROPN-190			Non-IC	RADJ-140	IC	RLNS-140
Open Narrow Flange 705 White 705A Clear Diffuse 705G Gold Diffuse 705AZ Clear Specular 705BLZ Black Specular 705GZ Gold Specular	120 BR40 120 PAR38						
							
Non-IC	ROPN-200						

NOTES:

- 1 Maximum wattage listed. Lower wattage lamps may be used.
- 2 Lens trims and WETlites™ are wet location listed. All others are damp location.
- 3 Shallow trims may be used for lower lamp position. See C & 7 Series Trims.

* For plastic flange add suffix PF

Lithonia Lighting

Acuity Lighting Group, Inc.

Recessed Downlighting

One Lithonia Way, Conyers, GA 30012

Phone: 800-315-4935 Fax: 770-860-3106

In Canada: 160 avenue Labrosse, Point-Claire, P.Q., H9R 1A1

www.lithonia.com

Xenon

NEW

Ordering Information

Low-Profile Xenon Fixture

Intended Use

For use where accent light is needed. Ideal for cabinet lighting in kitchens, offices and bookcases.

Features

Cool operation with clean, bright, white illumination.

White or bronze finish.

12V Xenon bulb(s) included.

Standard direct-wire (poke-home connectors included) or plug-in (5' corded plug included).

High/low switch for optimum light output.

13" connector cord included, so more fixtures can be added anytime.

Available in resale packs of 6.

UL listed to US and Canadian standards.

Example: **UCX 2 120 CSW BZ R6**

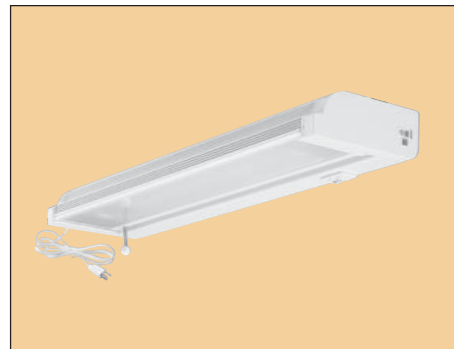
Length	Model Number ¹		Lamps (included)	Packaged ²
Xenon	White finish	Bronze finish		
9"	UCX 1 120 CSW R6	UCX 1 120 CSW BZ R6	1-18W 12V Xenon	6
12"	UCX 2 120 CSW R6	UCX 2 120 CSW BZ R6	2-18W 12V Xenon	6
18"	UCX 3 120 CSW R6	UCX 3 120 CSW BZ R6	3-18W 12V Xenon	6
24"	UCX 4 120 CSW R6	UCX 4 120 CSW BZ R6	4-18W 12V Xenon	6

NOTES:

1 Lamps included.

2 Resale packs must be ordered in increments of 6.

Halogen

L-7

Swivel Halogen Fixture

Intended Use

For use when accent light is needed. Ideal for cabinet lighting in kitchens, office and bookcases.

Features

Fixture head rotates 20° backward and 45° forward to aim light where needed.

White or bronze finish.

25W G8 halogen bulb(s) included.

Standard direct-wire (poke-home connectors included) or plug-in (5' corded plug included).

High/low switch for optimum light output.

13" connector cord included, so more fixtures can be added anytime.

Crisp, white light and quiet operation.

Resale package of 6.

UL listed to US and Canadian standards.

Example: **UCHD 2 120 CSW R6**

Ordering Information

Length	Model Number ¹		Lamps (included)	Packaged ²
Halogen	White finish	Bronze finish		
6"	UCHD 1 120 CSW R6	UCHD 1 120 CSW BZ R6	1-20W G8 Halogen	6
12"	UCHD 2 120 CSW R6	UCHD 2 120 CSW BZ R6	2-20W G8 Halogen	6
18"	UCHD 3 120 CSW R6	UCHD 3 120 CSW BZ R6	3-20W G8 Halogen	6
24"	UCHD 4 120 CSW R6	UCHD 4 120 CSW BZ R6	4-20W G8 Halogen	6

NOTES:

1 Lamps included.

2 Resale packs must be ordered in increments of 6.

Intended Use

Use in surface or suspended applications such as retail, manufacturing or renovation where high light levels in a compact luminaire design are required.

Features

Compact, low-profile design. High fixture performance.

Extended-height end caps for socket support. Full end cap available.

High-gloss baked white enamel or galvanized finish.

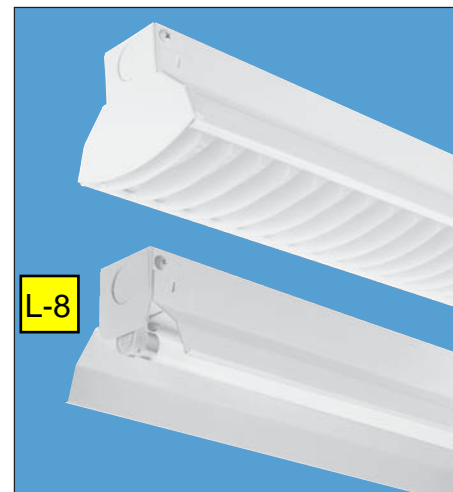
Choice of 1 or 2 lamps in 2', 3', 4' or 8' lengths.

Available reflectors include white, specular or galvanized finishes in solid or perforated styles.

White straight blade louver available for applications requiring additional shielding and cutoff.

Aircraft cable mounting hardware available.

Listings – UL Listed (standard). CSA Certified (see Options).



Ordering Information

Example: **MS5 1 54T5HO SMR MVOLT GEB10PS**

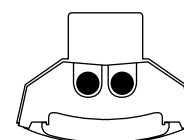
Series	Lamp type	Configuration	Finish	Voltage	Options
MS5 For tandem double-length unit, add prefix T¹. Example: TMS5	14T5 14W T5 (22") 21T5 21W T5 ((34")) 24T5HO 24W T5 HO (22") 28T5 28W T5 (46") 39T5HO 39W T5 HO ((34")) 54T5HO 54W T5 HO (46")	(blank) No reflector ASMR Asymmetric reflector SMR Symmetric reflector SBL White straight blade louver assembly (solid, white reflectors included)¹, ²	(blank) White SAR95 Specular aluminum reflector-Miro® (white channel) GALV Galvanized	347³ MVOLT* Others available. * 120-277V. Must specify GEB10PS.	GEB10PS Electronic ballast, ≤10% THD, program start GLR Internal fast-blow fuse⁴ GMF Internal slow-blow fuse⁴ PLF_G Plug-in wiring, specify 1, 2, or 3 branch circuits and hot wires (A=black, B=red, C=blue, AB or AC) EL55 Emergency battery pack (nominal 390-700 lumens)¹, ⁴, ⁵ CSA CSA Certified
Number of lamps 1, 2 Not included.					
Accessories (Order separately)					
See page 98 for others.					

NOTES:

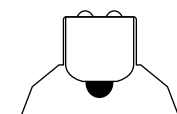
- Only available on 28W and 54W.
- Finish and reflector type not applicable.
- Available with 54T5HO lamp type only.
- Specify voltage.
- Not available in Canada.
- Not for use in combination with reflector.
- Available with 3', 4' and 8' lengths only.
- 120-277V only for power feed.
- Standard wire size for power feed is 18 gauge. For 12 gauge add **12AWG** to the end of catalog number. Consult factory for length of runs and required wire size.
- Based on SMR reflector.

Availability and Dimensions¹⁰

Nominal length	Series	Lamps per cross section	Lamps per fixture	Lamp type	Width in. (cm)	Depth in. (cm)	Length in. (cm)
2'	MS5	1, 2	1, 2	14T5, 24T5HO	4¾ (12.1)	2¹³⁄₁₆ (7.1)	22⁷⁄₁₆ (56.9)
3'	MS5	1, 2	1, 2	21T5, 39T5HO	4¾ (12.1)	2¹³⁄₁₆ (7.1)	34¾ (87)
4'	MS5	1, 2	1, 2	28T5, 54T5HO	4¾ (12.1)	2¹³⁄₁₆ (7.1)	46¹⁄₁₆ (116.9)
8'	MS5	1, 2	2, 4	28T5, 54T5HO	4¾ (12.1)	2¹³⁄₁₆ (7.1)	92¹⁄₁₆ (233.7)



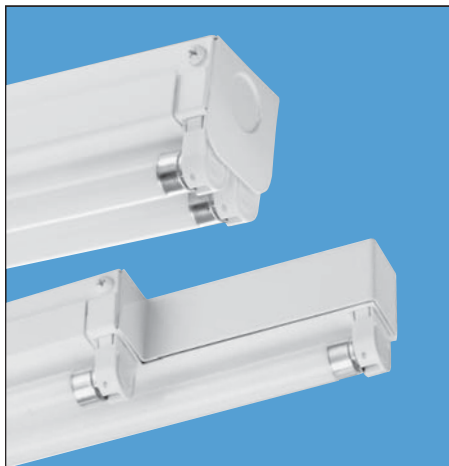
MS5 SBL



MS5 SMR

MS5

L-8 ALTERNATIVE



Low-Profile T5 Direct

Intended Use

Use for coves, display or any application requiring a low-profile luminaire that provides high light levels. Ideal for commercial, retail or manufacturing.

Features

Compact, low-profile design. High fixture performance.

Available in standard or staggered channels. Staggered design includes 4" stagger for uninterrupted continuous illumination.

Extended-height end caps for socket support.

High-gloss baked white enamel or galvanized finish. Heavy-duty 20-gauge channel.

Choice of 1 or 2 lamps in 2', 3', 4' or 8' lengths.

Listings – UL Listed (standard). CSA Certified (see Options).

Ordering Information

Example: MS5 1 54T5HO MVOLT GEB10PS

Series	Number of lamps	Lamp type	Voltage	Options
MS5 Standard channel	1, 2	14T5 14W T5 (22")	347²	GEB10PS Electronic ballast, ≤10% THD, program start
MS5SS Staggered channel	Not included.	21T5 21W T5 (34")	MVOLT*	GLR Internal fast-blow fuse ³
For tandem double-length unit, add prefix T.1 Example: TMS5		24T5HO 24W T5 HO (22")	Others available.	GMF Internal slow-blow fuse ³
		28T5 28W T5 (46")	* 120-277V. Must specify GEB10PS.	PLF_G Plug-in wiring, specify 1, 2, or 3 branch circuits and hot wires (A =black, B =red, C =blue, AB or AC)
		39T5HO 39W T5 HO (34")		EL55 Emergency battery pack (nominal 390-700 lumens) ^{3,4}
		54T5HO 54W T5 HO (46")		CSA CSA Certified

See page 98 for others.

Accessories (Order separately)

WGMS5Z	Wireguard, 4', Zinc.
THMS5	Tong hanger (1 pair).
1B	Ceiling spacer (adjusts 1-1/2" to 2-1/2" from ceiling)
SQ_	Swivel stem hanger (specify length in 2" increments).
MS5SSASR 2 48	Asymmetric reflector for staggered, 4', two-lamp configuration. ^{1,6}
MS5SSASR 1 48	Asymmetric reflector for staggered, 4', one-lamp configuration. ⁶

NOTES:

- Only available on 28W and 54W.
- Available with 54T5HO lamp type only.
- Specify voltage.
- Not available in Canada.
- For other lengths, replace 48 with correct length required; nominal 2' = 24, 3' = 36. Two reflectors required for 8' lengths.



MS5

Availability and Dimensions

Nominal length	Series	Lamps per cross section	Lamps per fixture	Lamp type	Width in. (cm)	Depth in. (cm)	Length in. (cm)
2'	MS5SS MS5	1, 2	1, 2	14T5, 24T5HO	2 (5.1)	2 1/4 (5.7)	22 1/2 (57.1), 26 1/2 (67.3) 22 7/16 (56.9)
3'	MS5SS MS5	1, 2	1, 2	21T5, 39T5HO	2 (5.1)	2 1/4 (5.7)	34 1/4 (87), 38 1/4 (97.1) 34 1/4 (87)
4'	MS5SS MS5	1, 2	1, 2	28T5, 54T5HO	2 (5.1)	2 1/4 (5.7)	46 1/16 (117), 50 1/16 (127.2) 46 1/16 (117)
8'	MS5SS MS5	1, 2 1, 2	1, 2 2, 4	28T5, 54T5HO	2 (5.1)	2 1/4 (5.7)	88 1/16 (223.7), 96 1/16 (243.8) 92 1/16 (233.7)

FEATURES & SPECIFICATIONS

INTENDED USE

Specification premium air-handling luminaires with small-cell louver options to provide general illumination with additional lamp shielding for recessed applications.

CONSTRUCTION

Black reveal provides floating louver appearance, conceals optional air-supply slots.

Louvers available in multiple cell configurations and choice of finish. Spring-action latches are standard, concealed in reveal.

Air-flow control available with optional heat-removal dampers and air-closure strips.

Integral T-bar safety clips hold T-bar securely; no fasteners required to install.

Overlapping flange and modular ceiling trims are factory-installed with standard swing-gate hangers.

Housing formed from cold-rolled steel. No asbestos is used in this product.

FINISH

Five-stage iron-phosphate pretreatment ensures superior paint adhesion and rust resistance. Painted parts finished with high-gloss, baked white enamel.

ELECTRICAL SYSTEM

Thermally-protected, resetting, Class P, HPF, non-PCB, UL Listed, CSA certified ballast is standard. Energy saving and electronic ballasts are sound rated A.

Luminaire is suitable for damp locations. AWM, TFN or THHN wire used throughout, rated for required temperatures.

LISTING

UL Listed and labeled (standard). CSA Certified or NOM Certified (see Options).

WARRANTY

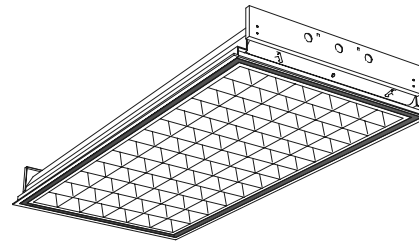
Guaranteed for one year against mechanical defects in manufacture.

Specifications subject to change without notice.

Catalog Number	
Notes	Type

Specification Premium Louvered Troffer

L-9 SP Air 2'x4'



Small-Cell Louvers
2, 3, 4 or 6 Lamps

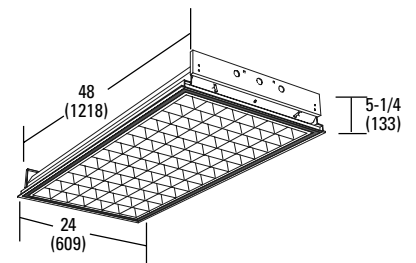
Specifications

Length: 48 (1218)

Width: 24 (609)

Depth: 5-1/4 (133)

Weight: 35 lbs (15.9kg)



All dimensions are inches (millimeters).

ORDERING INFORMATION

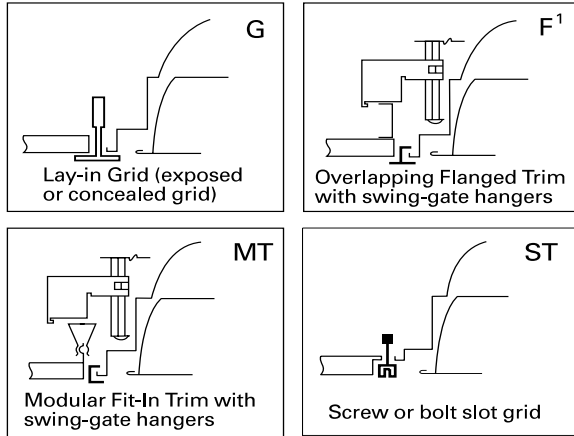
Example: **2SP G B 3 32 10515LS 120 GEB**

2SP							
Series	Trim type	Number of lamps	Lamp type	Voltage		Options	
2SP 2' wide	G Grid F Overlapping flanged MT Modular fit-in ST Screw slot	2, 3, 4, 6' Not included.	32 32W T8 (48") 40 40W T12 (48")	120, 277, 347, MVOLT ² Others available.		1/4 One 4-lamp ballast 1/3 One 3-lamp ballast GEB Electronic ballast, ≤20% THD GEB10IS Electronic ballast, ≤10% THD, Instant Start GEB10RS Electronic ballast, ≤10% THD, Rapid Start EL Emergency battery pack (nominal 300 lumens; see Fluorescent Battery Packs tab) GLR Internal fast-blow fuse GMF Internal slow-blow fuse PWS1836 6' prewire, 3/8" dia., 18-gauge, 3 wires LP___ Lamped, specify lamp type and color HRD Heat-removal dampers (H and D models only) ACS Air Closure Strips (A & D models only) APB Air-pattern control blades (A and D models only)	
			Louver	Louver finish			
			7815 78 cell louver, 1.5" deep 10515 105 cell louver, 1.5" deep 37775 377 cell louver, .75" deep	LD Low iridescent diffuse silver LS Low iridescent specular silver W White enamel			
		Air function					
		A Air supply/return (slots in side trim) H Heat removal (through lamp cavity, dampers available) D Combination A and H B Static (no air function, matching appearance)					

SP Air 2'x4' Small-Cell Louvers

MOUNTING DATA

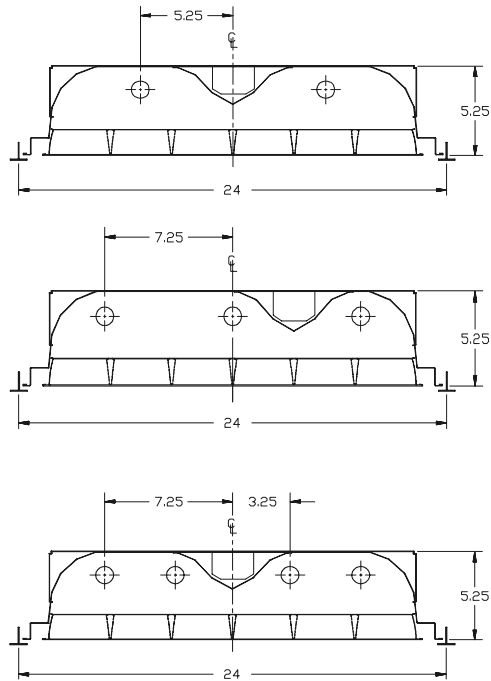
Continuous row mounting of flanged units requires CRE and CRM trim options (see Options).



NOTES:

1 Recommended rough-in dimensions for F trim fixtures 24" x 48" (Tolerance is +1/4", -0"). Swing-gate range 1-7/16" to 3-7/16", span 23-1/2" to 26-7/16".

DIMENSIONS



PHOTOMETRICS

Calculated using the zonal cavity method in accordance with IESNA LM41 procedure. Floor reflectances are 20%. Lamp configurations shown are typical. Full photometric data on these and other configurations available upon request.

2SP G B 3 32 7815LD

Report LTL 10541

Lumens per lamp - 2850 - Lum. efficiency- 66.1%

S/MH (along) 1.2 (across) 1.5

Coefficient of Utilization

Ceiling	80%			70%			50%		
Wall	70%	50%	30%	70%	50%	30%	50%	30%	10%
1	73	70	68	71	69	67	66	64	63
2	67	62	58	65	61	57	59	56	53
3	62	55	50	60	54	50	52	49	45
4	57	49	44	55	48	43	47	43	39
5	52	44	39	51	44	38	42	38	34
6	48	40	34	47	39	34	38	33	30
7	45	36	31	44	36	30	35	30	27
8	42	33	28	41	33	28	32	27	24
9	39	30	25	38	30	25	29	25	21
10	37	28	23	36	28	23	27	23	19

Zonal Lumens Summary

Zone	Lumens	%Lamp	%Fixture
0-30	1764	20.6	31.2
0-40	2936	34.3	52.0
0-60	4985	58.3	88.2
0-90	5650	66.1	100.0
90-180	0	0	0
0-180	5650	66.1	100.0

Energy (Calculated in accordance with NEMA standard LE-5)

LER.FL	ANNUAL ENERGY COST*	LAMP DESCRIPTION	LAMP LUMENS	BALLAST FACTOR	WATTS
58	\$4.14	(3) 32WT8/7815LD	2850	.88	86
57	\$4.21	(3) 32WT8/10515LD	2850	.88	86
52	\$4.62	(3) 32WT8/37775LD	2850	.88	86

* Comparative yearly lighting energy cost per 1000 lumens

2SP G B 3 32 10515LD

Report LTL 10607

Lumens per lamp - 2850 - Lum. efficiency- 65.1%

S/MH (along) 1.2 (across) 1.4

Coefficient of Utilization

Ceiling	80%			70%			50%		
Wall	70%	50%	30%	70%	50%	30%	50%	30%	10%
1	72	70	67	70	68	66	65	64	62
2	67	62	58	65	61	57	58	56	53
3	61	55	50	60	54	50	52	49	46
4	56	49	44	55	48	44	47	43	39
5	52	44	39	51	44	39	42	38	34
6	48	40	35	47	39	34	38	34	30
7	45	36	31	44	36	31	35	30	27
8	42	33	28	41	33	28	32	27	24
9	39	31	25	38	30	25	29	25	22
10	36	28	23	36	28	23	27	23	20

Zonal Lumens Summary

Zone	Lumens	%Lamp	%Fixture
0-30	1814	21.2	32.6
0-40	2979	34.8	53.5
0-60	5058	59.2	90.9
0-90	5567	65.1	100.0
90-180	0	0	0
0-180	5567	65.1	100.0

2SP G B 3 32 37775LD

Report LTL 10609

Lumens per lamp - 2850 - Lum. efficiency- 58.8%

S/MH (along) 1.2 (across) 1.2

Coefficient of Utilization

Ceiling Wall	80%			70%			50%		
	70%	50%	30%	70%	50%	30%	50%	30%	10%
1	65	63	61	64	62	60	59	58	57
2	60	56	53	59	55	52	53	51	49
3	56	50	46	54	50	46	48	45	42
4	51	45	41	50	45	40	43	39	37
5	48	41	36	46	40	36	39	35	32
6	44	37	32	43	37	32	35	31	28
7	41	34	29	40	33	29	32	28	25
8	38	31	26	37	31	26	30	26	23
9	36	28	24	35	28	24	27	24	21
10	34	26	22	33	26	22	25	22	19

Zonal Lumens Summary

Zone	Lumens	%Lamp	%Fixture
0-30	1765	20.6	35.1
0-40	2842	33.2	56.6
0-60	4653	54.4	92.6
0-90	5025	58.8	100.0
90-180	0	0	0
0-180	5025	58.8	100.0

FEATURES & SPECIFICATIONS

INTENDED USE

Specification premium air-handling luminaires offer general illumination for recessed applications.

CONSTRUCTION

Black reveal provides floating door appearance, conceals optional air-supply slots. Optional air flow controls available.

Standard door is fully gasketed flush steel with mitered appearance – completely frames shielding. Corners screwed together for rigidity, easy lens replacement. Rotary-action cam latches standard. Urethane foam gasket eliminates light leaks between door frame and housing.

Overlapping flange and modular ceiling trims factory-installed with standard swing-gate hangers.

Integral T-bar safety clips hold T-bar securely; no fasteners required.

Housing formed from cold-rolled steel. Acrylic shielding material 100% UV stabilized. No asbestos is used in this product.

FINISH

Five-stage iron-phosphate pretreatment ensures superior paint adhesion and rust resistance. Painted parts finished with high-gloss, baked white enamel.

ELECTRICAL SYSTEM

Thermally-protected, resetting, Class P, HPF, non-PCB, UL Listed, CSA certified ballast is standard. Energy saving and electronic ballasts are sound rated A.

Luminaire is suitable for damp locations. AWM, TFN or THHN wire used throughout, rated for required temperatures.

LISTING

UL Listed and labeled. Listed and labeled to comply with Canadian and Mexican Standards (see options).

WARRANTY

Guaranteed for one year against mechanical defects in manufacture.

Specifications subject to change without notice.

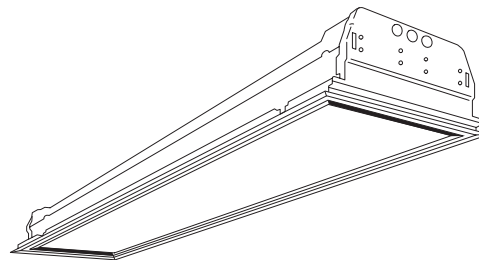
Catalog Number

Notes

Type

Specification Premium Air-Handling Troffer

L-10 SP Air 1'x4'



1, 2 or 3 Lamps

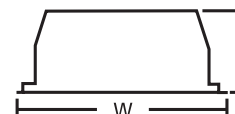
Specifications

Length: 48 (1218)

Width: 12 (305)

Depth: 4-7/8 (124)

Weight: 17 lbs (7.7 kg)



All dimensions are inches (millimeters).

ORDERING INFORMATION

Example: **SP G D 2 32 FW A12 120 GEB HRD APB**

SP							
Series		Number of lamps		Door frame ²		Voltage	
SP 1' wide		1, 2, 3 Not included.		(blank) Flush steel		120, 277, 347, MVOLT ³ Others available.	
Trim type		Lamp type		FM Flush aluminum, matte black		Options	
G Grid		32 32W T8 (48")		FN Flush aluminum, natural		1/3 One 3-lamp ballast	
F Overlapping flanged		40 40W T12 (48")		FW Flush aluminum, white		GEB Electronic ballast, ≤20% THD	
MT Modular fit-in				RN Regressed aluminum, natural		GEB10IS Electronic ballast, ≤10% THD, Instant Start	
ST Screw slot ¹				RM Regressed aluminum, matte black		GEB10RS Electronic ballast, ≤10%THD, Rapid Start	
				RW Regressed aluminum, white		EL Emergency battery pack (nominal 300 lumens; see Fluorescent Battery Packs tab)	
Air function				Diffuser type		GLR Internal fast-blow fuse	
A Air supply/return (slots in side trim)				A12 #12 pattern acrylic		GMF Internal slow-blow fuse	
H Heat removal (through lamp cavity, dampers available)				A12125 #12 pattern acrylic, .125" thick		PWS1836 6' prewire, 3/8" dia., 18-gauge, 3 wires	
D Combination A and H				A19 #19 pattern acrylic, .156" thick		SLL Spring-loaded door latches	
B Static (no air function, matching appearance)				A15 #15 pattern acrylic, .2" thick		LP__ Lamped, specify lamp type and color only	
				AC Dropped dish diffuser, matte white acrylic		HRD Heat-removal dampers (H and D models only)	
				PC1S 1/2" x 1/2" x 1/2" plastic cube louver, silver w/ flange		APB Air-pattern control blades (A and D models only)	
				PC2S 1-1/2" x 1-1/2" x 1" plastic cube louver, silver w/ flange		CRE Flanged trim for continuous row mounting (end)	
				PC3S 3/4" x 3/4" x 1/2" plastic cube louver, silver w/ flange		CRM Flanged trim for continuous row mounting (middle)	
						PAF Painted after fabrication (white enamel)	
						SSR Specular silver interior finish (95% reflective)	
						CSA Listed and labeled to comply with Canadian Standards	
						NOM Listed and labeled to comply with Mexican Standards	
						JP24 Palletized and stretch-wrapped (24 per), G and MT trim only	

NOTES:

1 Increases fixture depth.

2 Deep 2" regressed frame options available; specified as DRN, DRM, DRW. Increases fixture depth.

3 MVOLT available with GEB10IS only.

NOTES:

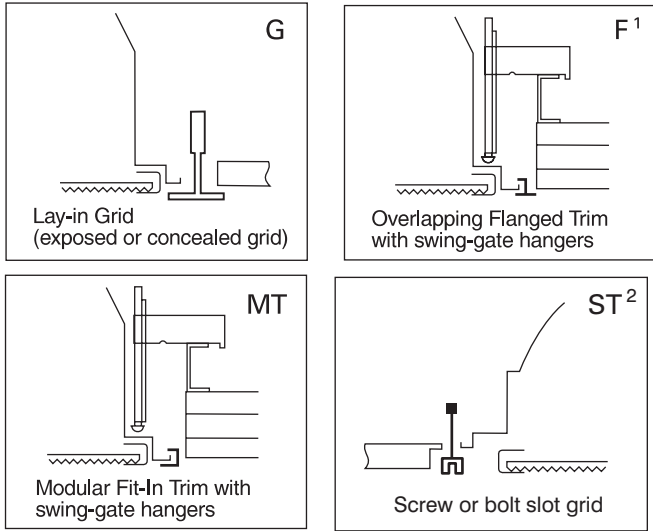
1 Increases fixture depth.

2 Deep 2" regressed frame options available; specified as **DRN**, **DRM**, **DRW**. Increases fixture depth.

3 MVOLT available with GEB10IS only.

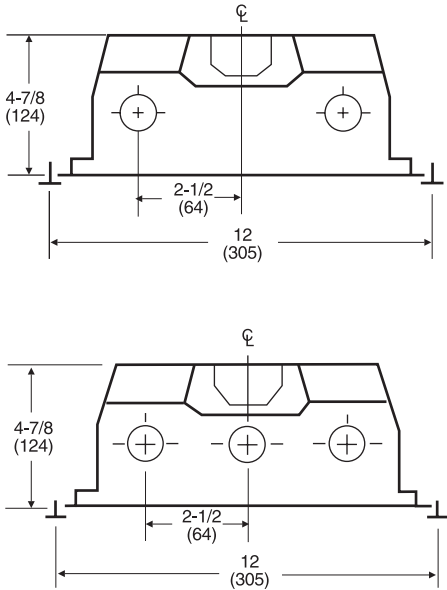
MOUNTING DATA

Continuous row mounting of flanged units requires CRE and CRM trim options (see Options).



- NOTES:
- 1 Recommended rough in dimensions for F trim fixtures 12" x 48" (Tolerance is +1/4", -0"). Swing-gate range 1-1/16" to 3-11/16", span 10-3/4" to 14-3/4".
 - 2 ST trim increases fixture depth.

DIMENSIONS



PHOTOMETRICS

Calculated using the zonal cavity method in accordance with IESNA LM41 procedure. Floor reflectances are 20%. Lamp configurations shown are typical. Full photometric data on these and other configurations available upon request.

SP G B 2 32 A12

Report LTL 4872

Lumens per lamp - 2900 - Lum. Eff. - 58.7%

S/MH (along) 1.2 (across) 1.2

Coefficient of Utilization

Ceiling	80%			70%			50%		
Wall	70%	50%	30%	70%	50%	30%	50%	30%	10%
1	65	62	60	63	61	59	59	57	56
2	60	56	52	58	55	52	53	50	48
3	55	50	46	54	49	45	48	44	42
4	51	45	41	50	44	40	43	39	36
5	47	40	36	46	40	35	39	35	32
6	44	37	32	43	36	31	35	31	28
7	41	33	28	40	33	28	32	28	25
8	37	30	25	37	29	25	29	25	22
9	35	27	22	34	27	22	26	22	19
10	32	25	20	31	24	20	24	20	17

Zonal Lumens Summary

Zone	Lumens	%Lamp	%Fixture
0-30	1156	19.9	34.0
0-40	1847	31.8	54.3
0-60	2912	50.2	85.6
0-90	3403	58.7	100.0
90-180	0	0.0	0.0
0-180	3403	58.7	100.0

SP G B 2 40 A12

Report LTL 3039

Lumens per lamp - 3150 - Lum. Eff. - 54.5%

S/MH (along) 1.2 (across) 1.2

Coefficient of Utilization

Ceiling	80%			70%			50%		
Wall	70%	50%	30%	70%	50%	30%	50%	30%	10%
1	60	58	56	59	57	55	55	53	52
2	56	52	49	54	51	48	49	47	45
3	52	47	43	50	46	43	44	42	39
4	48	42	38	47	42	38	40	37	34
5	44	38	34	43	37	33	36	33	30
6	41	34	30	40	34	30	33	29	26
7	38	31	27	37	31	27	30	26	23
8	35	28	24	34	28	24	27	23	21
9	32	25	21	32	25	21	24	21	18
10	30	23	19	29	23	19	22	19	16

Zonal Lumens Summary

Zone	Lumens	%Lamp	%Fixture
0-30	1195	19.0	34.8
0-40	1911	30.3	55.6
0-60	2981	47.3	86.8
0-90	3434	54.5	100.0
90-180	0	0.0	0.0
0-180	3434	54.5	100.0



FEATURES

OPTICAL SYSTEM

- Architectural surface-mount design using perforated metal diffuser over 1/8" thick white acrylic shield.
- Top and bottom prongs, cast in acrylic, hold diffuser in place.
- Diffuser is open top and bottom for direct and indirect illumination.
- ADA compliant.

SHIELDING OPTIONS

- Metal Diffuser, staggered Round holes (MDR). 52% open perforated steel with .075" diameter holes.
- Metal Diffuser, aligned Mini slots (MDM). 46% open perforated aluminum with .045" x .250" straight slots.

ELECTRICAL SYSTEM

- Thermally-protected, Class P, LPF, electromagnetic ballasts are standard for two-pin lamps.
- Class P thermally-protected high power factor electronic ballast are standard for four-pin lamps. (THD < 10%, PF .99).

HOUSING

- Housing formed from cold-rolled steel.
- Five-stage iron-phosphate pretreatment ensures superior paint adhesion and rust resistance. Painted parts finished with high-gloss, baked white enamel.

LISTING

- UL Listed and labeled. Listed and labeled to comply with Canadian and Mexican Standards (see options).

Specifications subject to change without notice.

Type

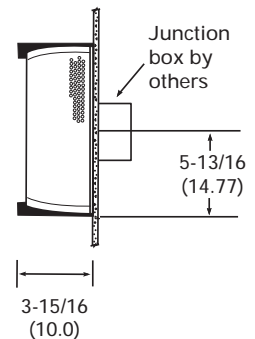
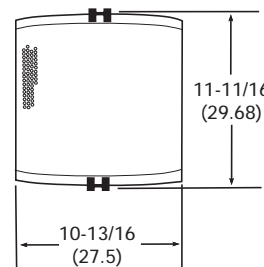
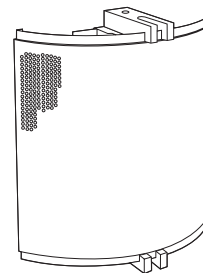
Catalog number

Wall Sconce

L-11

Perforated Shield

Compact Fluorescent
2 lamps



Avante
Recessed Direct/Indirect Lighting

ORDERING INFORMATION

Example: AVSP 26DTT MDR MVOLT GEB10

AVSP	2					
Series	Number of Lamps	Lamp type ¹	Diffuser	Voltage	Ballast	Options
AVSP	2	13TT 13W twin-tube 13DTT 13W quad-tube 26DTT 26W quad-tube	MDR Metal diffuser, round holes. MDM Metal diffuser, mini slots.	120 277 347 MVOLT ²	EMB Electromagnetic ballast. Requires two-pin lamp. (Not available as MVOLT) GEB10 Electronic ballast, ≤10% THD. Requires four-pin lamp. (13DTT and 26DTT only.)	ALB Anodized aluminum back plate. CSA Listed and labeled to comply with Canadian Standards. NOM Listed and labeled to comply with Mexican Standards. GLR Single fast-blow fuse (not available with MVOLT). GMF Single slow-blow fuse (not available with MVOLT). ELR Remote emergency battery pack. Remote test switch provided.

Notes:

- 13TT for two-pin lamp only; others for two or four-pin lamp.
- Will operate any voltage between 120V and 277V (50Hz and 60Hz). Available with GEB10 ballast only.

Additional options available.
Consult factory.

Wall Sconce, Avante Perforated Shield

For photometric information, consult factory.

AVSP

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AVSP.p65

 **LITHONIA LIGHTING**
ARCHITECTURAL INDOOR LIGHTING

P.O. BOX A, CONYERS, GEORGIA 30012, TELEPHONE 770-922-9000, FAX 770-860-3106
IN CANADA: 1100 50TH AVE., LACHINE, QUEBEC H8T 2V3, www.lithonia.com

Die-Formed Steel Exits

Intended Use

Suitable for applications requiring heavy duty steel exit signage such as a light industrial warehouse or manufacturing facility.

Features

Heavy-gauge, die-formed steel housing. Impact-resistant color panels.

Knockout chevrons for choice of direction.
Long-life LEDs feature very low energy consumption and rated life up to 25 years.
Universal mounting — top, back or end (canopy included).

Listings – UL Listed. NOM Certified.

Ordering Information

Example: **LX S W 1 R 120/277 EL N**

Family	Face type	Number of faces
LX LED	S Stencil P Panel¹	1 Single 3 Single with extra faceplate and color panel
Housing color		
(blank) Matte black		
W White		

Panel color	Operation
R Red G Green	(blank) Standard non-emergency EL N Nickel-cadmium battery
Input voltage	
120/277 Dual voltage	

Accessories ²	(Order separately)
ELA B US12	12" stem kit with black canopy.

NOTES:

- Special wording available on panel face; consult factory.
- For additional accessories see page 307.

Dimensions are shown in **inches (millimeters)** unless otherwise noted.

LED



STANDARD/EMERGENCY

Width: 11-1/2 (292)
Height: 7-7/8 (200)
Depth: 2-1/2 (64)
(Add 7/8 (22) for canopy)
Weight: 5 lbs. (2.2 kgs.)



Options	Certification
For additional options and fixture compatibility, see page 307.	(blank) NOM UL Listed NOM Certified

Electrical Application Data

Primary Circuit Type	Volts	Amps	Watts
Standard	120	.04	.57
LED red	277	.05	.68
Standard LED green	120	.05	.62
LED green	277	.05	.72
Emergency LED red	120	.04	.72
LED green	277	.05	.92

Self-Luminous Exits

Intended Use

Ideal for applications where electrical power cannot be provided.

Features

Tritium-filled gas tubes require no electrical input and are rated for 10 or 20-year life.

Universal directional indicators and mounting (canopy included).

Completely sealed housing.
Explosion-proof/hazardous location. Suitable for wet locations.
Tamperproof mounting hardware included.
10 or 20-year total customer warranty (varies with luminous life option chosen).

Listings – UL Listed.

Ordering Information

Example: **D S W 1 R**

Family	Number of faces	Faceplate color	Luminous life	Options
D Self-luminous	1 Single 2 Double	R Red G Green	(blank) 10 years 20 20 years	VR Vandal shield ^{1,2,4} AA Aluminum anodized frame ³ IF Institutional frame ⁴
Face type				
S Stencil				
Housing color				
(blank) Black				
W White				
AL Aluminum				

NOTES:

- Only available in single face.
- Only available with aluminum housing color.
- Available in all housing colors.
- Consult factory for dimensional details.

Self-Luminous



Dimensions are shown in **inches (millimeters)** unless otherwise noted.

Plastic Frame	Option AA (Aluminum Anodized)
EXIT	EXIT
TOP MOUNTING	END MOUNTING
SINGLE FACE	SINGLE FACE
DOUBLE FACE	DOUBLE FACE
Width: 14-3/16 (360) Height: 9-5/8 (244) Depth: Single - 1-1/2 (38) Double - 3 (76) Weight: Single - 3 lbs. (1.4 kgs.) Double - 6 lbs. (2.8 kgs.)	Width: 12-3/4 (324) Height: 8-1/4 (209) Depth: Single - 1-1/2 (38) Double - 2-11/16 (68) Weight: Single - 4 lbs. (1.8 kgs.) Double - 8 lbs. (3.6 kgs.) (Canopy provided with double face only)

EXTERIOR

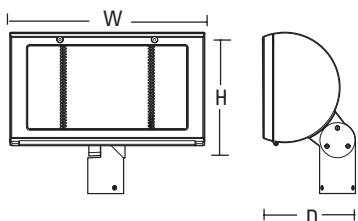


Shown with standard swivel mount

Ordering Information

Designation	Distribution	Voltage
<u>High Pressure Sodium</u>	SP Spot	120
KFL2 70S	BP Horiz. flood ³	208⁴
KFL2 100S	RN Horiz. spot, narrow	240⁴
KFL2 150S		277
KFL3 250S	RM Horiz. spot, medium	347
KFL3 400S		480
<u>Metal Halide</u>	RW Horiz. spot, wide	TB⁵
KFL2 70M	HPN Vertical flood, narrow	
KFL2 100M	HPM Vertical flood, medium	
KFL2 150M		
KFL2 175M	HPW Vertical flood, wide	
KFL3 200M¹		
KFL3 250M	FT Forward throw	
KFL3 320M¹		
KFL3 350M¹		
KFL3 400M²		

Wattage	Ballast	Lamp Type	Beam Spread H°xV°	NEMA Dist.
<u>High Pressure Sodium</u>				
150	SP	HX-HPF	E17 142x127	3x1
150	HPW	HX-HPF	E17 39x12	7x6
400	SP	CWA	ET18 60x13	4x1
400	HPW	CWA	ET18 144x140	7x7
<u>Metal Halide</u>				
175	SP	CWA	ED17 27x15	2x1
175	HPW	CWA	ED17 147x127	7x6
400	SP	CWA	BT28 42x17	3x1
400	HPW	CWA	BT28 146x140	7x7



Architectural Floodlights

Intended Use

For landscape and facade lighting.

Features

Housing – Welded, extruded body with cast end caps. Standard finish is dark bronze (DDB) corrosion-resistant polyester powder. Other architectural colors available.

Lens Frame – Cast aluminum door frame is hinged and secured by stainless steel fasteners. Closed-cell silicone gasket prevents entrance of contaminants.

Lens – Clear, impact-resistant, tempered glass lens.

Mounting – Standard mount is two-piece, heavy-duty, cast-aluminum swivel with integral wiring compartment (pictured). Swivel fits over standard 1½" (1.9" OD) to 2" (2.38" OD) tenon. Painted steel yoke with 3-foot, 16/3 SEO cable or threaded knuckle mount are optional.

Optics – Anodized aluminum reflectors; segmented, specular or hammertone finish.

Electrical – 150W and below utilizes a high-reactance, high power factor ballast. 175W and above utilizes a constant-wattage autotransformer ballast. Both ballast are copper wound and 100% factory tested. Optional pulse start ballast available.

Socket – Medium-base (KFL2) or mogul-base (KFL3) porcelain socket with copper alloy, nickel-plated screw shell and center contact. 4KV pulse rated. UL listed 660W, 600V.

Listings – UL Listed (standard). CSA Certified or NOM Certified (see Options). UL listed for wet locations. IP65 rated in accordance with standard IEC 529.

Example: KFL2 70S HPN 120 SF LPI

Optional mounting
<u>Installed</u>
YK Yoke mount
THK Threaded knuckle mount
<u>Shipped separately</u>
KFLSTM Stanchion mount
KFLSTMTHK Stanchion mount for THK option ⁶
TM Tenon base mount
KFLWMA Wall mount arm
KFLWMATHK Wall-mount arm for THK option ⁶
MP Mounting plate ⁷
FCRA Crossarm adapter ⁷
TS Tenon slipfitter ⁷
KFLTMB Twin mounting bar
KFLTMBTHK Twin mounting bar for THK option ⁶
AJB Architectural J-box for THK option ⁶
KFLTBS Triangular base

Options/Accessories
<u>Installed</u>
SF Single fuse, 120V, 277V, 347V (n/a TB)
DF Double fuse, 208V, 240V, 480V (n/a TB)
PE Photoelectric cell, button type (n/a TB)
QRS Quartz restrike system (KFL3 only, 100W max.) (lamp not included)
EC Emergency circuit
CR Enhanced corrosion resistance
CFRO Color lens/rose
CFBL Color lens/blue
SCWA Super CWA pulse start ballast (n/a with HPS, 70M, 100M or 175M)
LPI Lamp included as standard
L/LP Less lamp
CSA CSA Certified
NOM NOM Certified (consult factory)

For optional architectural colors, see page 485.

<u>Shipped separately⁸</u>
UV Upper visor
EV Eggcrate visor (black)
FV Full visor
BV Bottom visor
WG Wireguard
BD Barn door
HLV Horizontal louver (black)
VLV Vertical louver (black)
BVG Bubble vandal guard

NOTES:

- Must be ordered with SCWA.
- ED-28 reduced jacket lamp required.
- KFL2 only.
- Consult factory for availability in Canada.
- Optional multi-tap ballast (120V, 208V, 240V, 277V). In Canada 120V, 277V, 347V; ships as 120V/347V.
- For use with THK mounting only. Must include THK mount option on fixture.
- For use with yoke mounting only. Must include yoke mount option on fixture.
- Field modification required unless ordered with fixture.

FEATURES & SPECIFICATIONS

INTENDED USE — Outdoor storage areas, warehouse and factory perimeters and loading docks.

CONSTRUCTION — Rugged, corrosion-resistant, die-cast aluminum. Corrosion-resistant external hardware includes slotted hex-head fasteners.

FINISH — Standard finish is electrostatically-applied, oven-cured, dark bronze (DDB) corrosion resistant polyester powder.

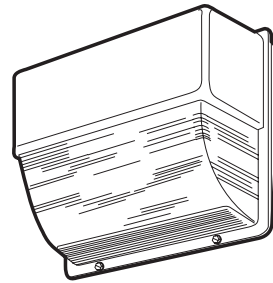
OPTICAL SYSTEM — Reflector is specular anodized aluminum. Refractor is prismatic borosilicate glass which is sealed and gasketed to inhibit the entrance of outside contaminants.

ELECTRICAL SYSTEM — High reactance, high power factor ballast for 70-150W. Constant wattage auto-transformer for 200W and above. Encased and potted solid state ignitors. Ballast is copper wound and 100% factory tested. Meets ANSI standards and is UL listed. Electrical components are mounted in hinged front cover that includes primary and secondary electrical disconnect. (For 50 hertz availability, consult factory). Porcelain (mogul-base; 175M and above), horizontally oriented with copper alloy, nickel-plated screw shell and center contact. 4KV pulse rated. Medium-base (150M, 100S and below) UL listed 660W, 600V. Mogul-base: UL listed 1500W, 600V.

INSTALLATION — Back housing is separated from front housing, eliminating ballast weight and promoting easy handling. Top 3/4" threaded wiring access. Back access through removable 3/4" knockout. Feed-thru wiring can be achieved by using a conduit tee. Mount on any vertical surface. **Not recommended in applications where a sprayed stream of water can come in direct contact with glass lens.**

LISTING — UL Listed (standard). CSA or NOM Certified (see Options). UL listed suitable for wet locations. IP65 rated (250 watt and below) or IP54 rated (400 watt) in accordance with IEC Standard 529.

Catalog Number	
Notes	Type



Wall-Paks

EXTERIOR

TWH

HIGH PRESSURE SODIUM

70W, 100W, 150W, 200W, 250W, 400W
8' to 25' Mounting

Specifications

Height: 15-3/4" (40cm)
Width: 16-1/4" (42.6cm)
Depth: 8" (20.3cm)
Weight: 26-42 lbs. (12-19 kg)

ORDERING INFORMATION

Choose the boldface catalog nomenclature that best suits your needs and write it on the appropriate line. Order accessories as separate catalog numbers (shipped separately).

Example: **TWH 70S 120 LPI**

TWH			Options	
Series	Wattage /lamp	Voltage		
TWH		120		
	70S¹	208³		
	100S¹	240³		
	150S^{1,2}	277		
	200S	347		
	250S	480³		
	400S	TB⁴		
		TBV⁵		
Accessories			Architectural Colors (optional)	
Order as separate catalog number.			DNA	Natural aluminum
RK1 PEB1 Photoelectric control kit (120V)			DBL	Black
PE3 NEMA twist-lock photocontrol (347V)			DSB	Steel blue
PE4 NEMA twist-lock photocontrol (480V)			DMB	Medium bronze
			DGC	Charcoal gray
			DTG	Tennis green
			DBR	Bright red
			DSS	Sandstone
			DWH	White
			Accessories	
			Order as separate catalog number.	
			RK1 PEB1	Photoelectric control kit (120V, button type)
			RK1 PEB2	Photoelectric control kit (120V, button type)
			RK1 PEB3	Photoelectric control kit (347V, button type)
			PE1	NEMA twist-lock photocontrol (120V/208V/240V)
			PE3	NEMA twist-lock photocontrol (347V)
			PE4	NEMA twist-lock photocontrol (480V)
			PE7	NEMA twist-lock photocontrol (277V)

NOTES:

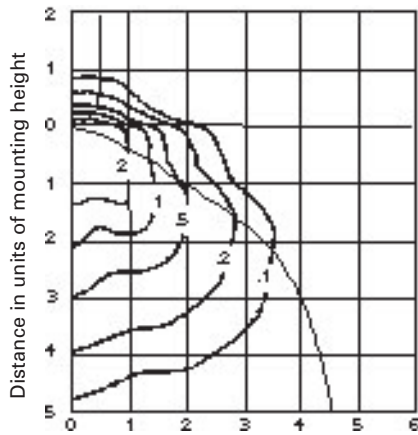
- Not available with TBV.
- Operates 55V lamp.
- Not available in Canada.
- Optional multi-tap ballast (120, 208, 240, 277V). (120, 277, 347V in Canada).
- Optional 5-tap ballast (120, 208, 240, 277, 480V).
- Not available with multi-tap ballast.
- Lamp not included.
- Quartz lamp wattage not to exceed ballast wattage rating.
- Black finish only.
- Not available in 480V and TB.
- Photocell not included.
- Requires modification.
- Available 70, 100, 150 watt/120V only.

TWH High Pressure Sodium Wall-Paks

Coefficient of Utilization _____
Initial Footcandles _____

TWH 70S Test report no. 94121701

Coefficients of utilization

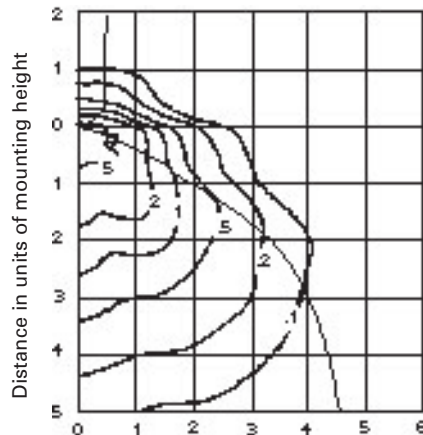


Distance in units of mounting height

70W, high pressure sodium lamp, horizontal lamp orientation, 12' mounting height, 6,300 rated lumens. **Total fixture efficiency: 60.7%**

TWH 100S Test report no. 94121501

Coefficients of utilization

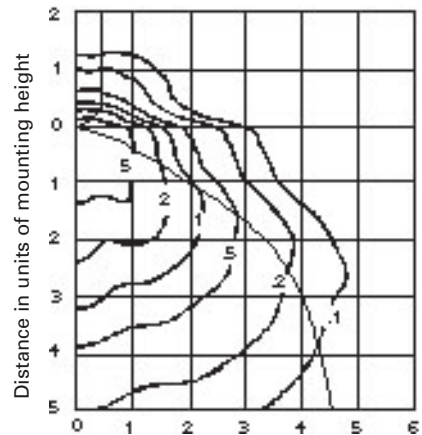


Distance in units of mounting height

100W, high pressure sodium lamp, horizontal lamp orientation, 12' mounting height, 9,500 rated lumens. **Total fixture efficiency: 60.7%**

TWH 150S Test report no. 94121504

Coefficients of utilization

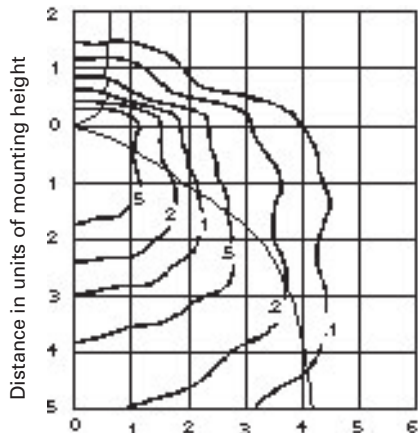


Distance in units of mounting height

150W, high pressure sodium lamp, horizontal lamp orientation, 12' mounting height, 16,000 rated lumens. **Total fixture efficiency: 60.5%**

TWH 200S Test report no. 94121402

Coefficients of utilization

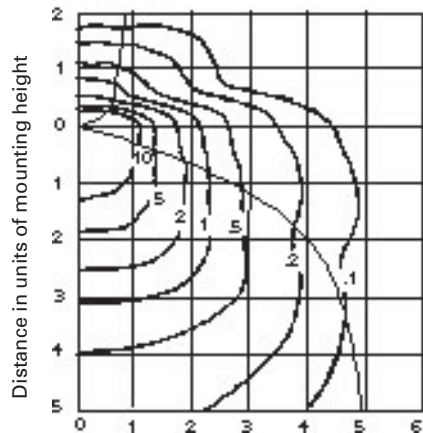


Distance in units of mounting height

200W, high pressure sodium lamp, horizontal lamp orientation, 12' mounting height, 22,000 rated lumens. **Total fixture efficiency: 59.4%**

TWH 250S Test report no. 94121002

Coefficients of utilization

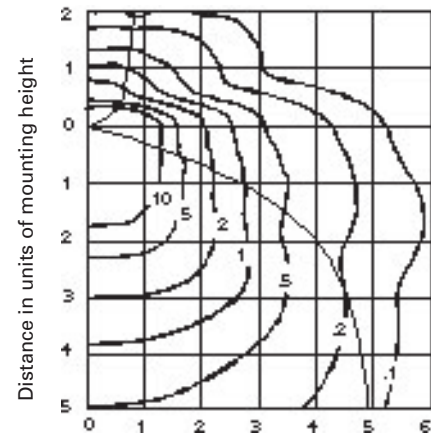


Distance in units of mounting height

250W, high pressure sodium lamp, horizontal lamp orientation, 12' mounting height, 27,500 rated lumens. **Total fixture efficiency: 70.9%**

TWH 400S Test report no. 94121001

Coefficients of utilization



Distance in units of mounting height

400W, high pressure sodium lamp, horizontal lamp orientation, 12' mounting height, 50,000 rated lumens. **Total fixture efficiency: 70.9%**

Mounting Height Correction Factor

(Multiply the fc level by the correction factor)

20 ft. = .36
10 ft. = 1.44
15 ft. = .64



Lithonia Lighting

Acuity Lighting Group, Inc.

Outdoor Lighting

One Lithonia Way, Conyers, GA 30012

Phone: 770-922-9000 Fax: 770-918-1209

In Canada: 160 avenue Labrosse, Point-Claire, P.Q., H9R 1A1

www.lithonia.com

SECTION 16710A

PREMISES DISTRIBUTION SYSTEM

09/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/TIA/EIA-568-B	(2000) Transmission Performance Specifications for 4-pair 100 ohm Category 5E Cabling
EIA ANSI/TIA/EIA-568-B.2-1	(2002) Transmission Performance Specifications for 4-pair 100 ohm Category 6 Cabling
EIA ANSI/TIA/EIA-569-A	(2001) Commercial Building Standard for Telecommunications Pathways and Spaces**
EIA ANSI/TIA/EIA-606A	(2002) Administration Standard for the Telecommunications Infrastructure
EIA ANSI/TIA/EIA-607A	(2002) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
EIA TIA/EIA-TSB-67	(1995) Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems**

IBM CORPORATION (IBM)

IBM GA27-3361-07	(1987) LAN Cabling System - Planning and Installation
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code
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UNDERWRITERS LABORATORIES (UL)

UL 50	(1995; Rev thru Nov 1999) Enclosures for Electrical Equipment
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1.2 SYSTEM DESCRIPTION

The premises distribution system shall consist of inside-plant horizontal, riser, and backbone cables and connecting hardware to transport telephone and data (including LAN) signals between equipment items in a building.

1.3 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 0 to 60 degrees C and in the range of 0 to 95 percent relative humidity, noncondensing.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Premises Distribution System; G

Detail drawings including a complete list of equipment and material. Detail drawings shall contain complete wiring and schematic diagrams and other details required to demonstrate that the system has been coordinated and will function properly as a system. Drawings shall include vertical riser diagrams, equipment rack details, elevation drawings of telecommunications closet walls, outlet face plate details for all outlet configurations, sizes and types of all cables, conduits, and cable trays. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation.

Installation; G

Record drawings for the installed wiring system infrastructure per EIA ANSI/TIA/EIA-606A. The drawings shall show the location of all cable terminations and location and routing of all backbone and horizontal cables. The identifier for each termination and cable shall appear on the drawings.

SD-03 Product Data

Record Keeping and Documentation; G

Documentation on cables and termination hardware in accordance with EIA ANSI/TIA/EIA-606A.

Spare Parts;

Lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval

of detail drawings, not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking.

Manufacturer's Recommendations; G

Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations, prior to installation shall be provided. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

Test Plan; G

Test plan defining the tests required to ensure that the system meets technical, operational and performance specifications, 60 days prior to the proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

Qualifications; G

The qualifications of the Manufacturer, Contractor, and the Installer to perform the work specified herein. This shall include proof of the minimum qualifications specified herein.

SD-06 Test Reports

Test Reports; G

Test reports in booklet form with witness signatures verifying execution of tests. Test results will also be provided on 89 mm diskettes in ASCII format. Reports shall show the field tests performed to verify compliance with the specified performance criteria. Test reports shall include record of the physical parameters verified during testing. Test reports shall be submitted within 7 days after completion of testing.

SD-07 Certificates

Premises Distribution System

Written certification that the premises distribution system complies with the EIA ANSI/TIA/EIA-568-B.2-1, EIA ANSI/TIA/EIA-569-A, and EIA ANSI/TIA/EIA-606A standards.

Materials and Equipment

Where materials or equipment are specified to conform, be constructed or tested to meet specific requirements, certification

that the items provided conform to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

Installers; G

The Contractor shall submit certification that all the installers are factory certified to install and test the provided products.

1.5 QUALIFICATIONS

1.5.1 Minimum Contractor Qualifications

All work under this section shall be performed by and all equipment shall be furnished and installed by a certified Telecommunications Contractor, hereafter referred to as the Contractor. The Contractor shall have the following qualifications in Telecommunications Systems installation:

- a. Contractor shall have a minimum of 3 years experience in the application, installation and testing of the specified systems and equipment.
- b. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products.
- c. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

1.5.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract will be from manufacturers that have a minimum of 3 years experience in producing the types of systems and equipment specified.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust or other contaminants.

1.7 OPERATION AND MAINTENANCE MANUALS

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a

part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

1.8 RECORD KEEPING AND DOCUMENTATION

1.8.1 Cables

A record of all installed cable shall be provided in hard copy format per EIA ANSI/TIA/EIA-606A. The cable records shall include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility per EIA ANSI/TIA/EIA-606A.

1.8.2 Termination Hardware

A record of all installed patch panels and outlets shall be provided in hard copy format per EIA ANSI/TIA/EIA-606A. The hardware records shall include only the required data fields per EIA ANSI/TIA/EIA-606A.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 1 year prior to installation. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70.

2.2 UNSHIELDED TWISTED PAIR CABLE SYSTEM

2.2.1 Backbone Cable

Backbone cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B for Category 6 unshielded twisted pair cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Conductors shall be solid untinned copper 24 AWG. Cable shall be rated CMR per NFPA 70.

2.2.2 Horizontal Cable

Horizontal cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B.2-1 for Category 6. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMG or CMP, as appropriate, per NFPA 70.

2.2.3 Connecting Hardware

Connecting and cross-connecting hardware shall be the same category as the cable it serves. Hardware shall be in accordance with EIA ANSI/TIA/EIA-568-B.

2.2.3.1 Telecommunications Outlets

Outlet assemblies used in the premises distribution system shall consist of modular jacks assembled into both simplex and duplex outlet assemblies in single or double gang covers as specified in this section and as indicated on the drawings. Wall and desk outlet plates shall come equipped with two modular jacks, with the top or left jack labeled "voice" and the bottom or right jack labeled "data". Modular jacks shall be the same category as the cable they terminate and shall meet the requirements of EIA

ANSI/TIA/EIA-568-B and shall meet the Link Test parameters as listed in EIA TIA/EIA-TSB-67 and supplemented by EIA ANSI/TIA/EIA-568-B.2-1. Modular jack pin/pair configuration shall be per EIA ANSI/TIA/EIA-568-B. Modular jacks shall be keyed. Faceplates shall be provided and shall be ivory in color, stainless steel.

2.2.3.2 Patch Panels

Patch panels shall consist of eight-position modular jacks, with rear mounted type 110 insulation displacement connectors, arranged in rows or columns on wall mounted panels. Jack pin/pair configuration shall be per EIA ANSI/TIA/EIA-568-B. Jacks shall be unkeyed. Panels shall be provided with labeling space. The modular jacks shall conform to the requirements of EIA ANSI/TIA/EIA-568-B, and shall be rated for use with Category 6 cable in accordance with EIA ANSI/TIA/EIA-568-B.2-1 and shall meet the Link Test parameters as listed in EIA TIA/EIA-TSB-67 and supplemented by EIA ANSI/TIA/EIA-568-B.2-1.

2.2.3.3 Patch Cords

Patch cords shall be cable assemblies consisting of flexible, twisted pair stranded wire with eight-position plugs at each end. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Patch cords shall be wired straight through; pin numbers shall be identical at each end and shall be paired to match patch panel jack wiring per EIA ANSI/TIA/EIA-568-B.

Patch cords shall be unkeyed. Patch cords shall be factory assembled. Patch cords shall conform to the requirements of EIA ANSI/TIA/EIA-568-B.2-1 for Category 6.

2.2.3.4 Terminal Blocks

Terminal blocks shall be wall mounted wire termination units consisting of insulation displacement connectors mounted in plastic blocks, frames or housings. Blocks shall be type 110 which meet the requirements of EIA ANSI/TIA/EIA-568-B, and shall be rated for use with Category 6 cable in accordance with EIA ANSI/TIA/EIA-568-B.2-1 and shall meet the Link Test parameters as listed in EIA TIA/EIA-TSB-67 and supplemented by EIA ANSI/TIA/EIA-568-B.2-1. Blocks shall be mounted on standoffs and shall include cable management hardware. Insulation displacement connectors shall terminate 22 or 24 gauge solid copper wire as a minimum, and shall be connected in pairs so that horizontal cable and connected jumper wires are on separate connected terminals.

2.3 EQUIPMENT RACKS

2.3.1 Wall Mounted Open Frame

Wall mounted open frame equipment racks shall be steel relay racks to mount equipment 580 mm wide with standoff brackets for wall mounting. Uprights shall be drilled and tapped 12-24 in a 13 mm pattern. Standoff brackets shall be of sufficient length for a 150 mm clearance between rack and wall. Wall mounted open frame racks shall be hinged. AC outlets shall be provided as shown.

2.3.2 Cable Guides

Cable guides shall be specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 580 mm equipment racks. Cable guides shall consist of ring or bracket-like devices mounted on rack panels for horizontal use or individually mounted for vertical use. Cable guides shall mount to racks by screws and/or nuts and lockwashers.

2.3.3 Floor Mounted Cabinets

Equipment cabinets shall be floor mounted enclosures with side panels, acrylic plastic front doors, rear louvered metal doors, depth-adjustable front and rear mounting rails, and louvered top. Ventilation fans will be included. Vertical cable management devices shall be integral to the cabinet. Power strips with 6 outlets shall be provided within the cabinet.

Equipment racks shall mount equipment 580 mm wide and shall be 1828 mm high and 760 mm deep. Cabinet exteriors shall be painted ivory/off-white .

2.3.4 Wall Mounted Cabinets

Wall mounted cabinets shall conform to UL 50 and have boxes constructed of zinc-coated sheet steel with dimensions not less than shown on drawings. Trim shall be fitted with hinged door and flush catch. Doors shall provide maximum openings to the box interiors. Boxes shall be provided with 19 mm plywood backboard painted white or a light color. A duplex AC outlet shall be installed within the cabinet.

2.4 EQUIPMENT MOUNTING BACKBOARD

Plywood backboards shall be provided, sized as shown, painted with white or light colored paint.

2.5 TELECOMMUNICATIONS OUTLET BOXES

Electrical boxes for telecommunication outlets shall be 117 mm square by 53 mm deep with minimum 9 mm deep single or two gang plaster ring as shown. Provide a minimum 25 mm conduit.

PART 3 EXECUTION

3.1 INSTALLATION

System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and as shown. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be provided. Components shall be labeled in accordance with EIA ANSI/TIA/EIA-606A. Penetrations in fire-rated construction shall be firestopped in accordance with Section 07840 FIRESTOPPING. Conduits, outlets and raceways shall be installed in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Wiring shall be installed in accordance with EIA ANSI/TIA/EIA-568-B and as specified in Section 16415A ELECTRICAL WORK, INTERIOR. Wiring, and terminal blocks and outlets shall be marked in accordance with EIA ANSI/TIA/EIA-606A. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with ac power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance and, if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

3.1.1 Horizontal Distribution Cable

The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Fiber optic cables shall be installed either in conduit or through type cable trays to prevent microbending losses. Copper cable not in a wireway shall be suspended a minimum of 200 mm above ceilings by cable supports no greater than 1.5 m apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 300 mm shall be maintained when such placement cannot be avoided. Cables shall be terminated; no cable shall contain unterminated elements. Minimum bending radius shall not be exceeded during installation or once installed. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered. In raised floor areas, cable shall be installed after the flooring system has been installed. Cable 1.8 m long shall be neatly coiled not less than 300 mm in diameter below each feed point in raised floor areas.

3.1.2 Riser and Backbone Cable

Vertical cable support intervals shall be in accordance with manufacturer's recommendations. Cable bend radius shall not be less than ten times the outside diameter of the cable during installation and once installed. Maximum tensile strength rating of the cable shall not be exceeded. Cable shall not be spliced.

3.1.3 Telecommunications Outlets

3.1.3.1 Faceplates

As a minimum each jack shall be labeled as to its function and a unique

number to identify cable link.

3.1.3.2 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 150 mm of slack cable loosely coiled into the telecommunications outlet boxes.

Minimum manufacturers bend radius for each type of cable shall not be exceeded.

3.1.3.3 Pull Cords

Pull cords shall be installed in all conduit serving telecommunications outlets which do not initially have fiber optic cable installed.

3.1.4 Terminal Blocks

Terminal blocks shall be mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Industry standard wire routing guides shall be utilized.

3.1.5 Unshielded Twisted Pair Patch Panels

Patch panels shall be mounted in equipment racks with sufficient modular jacks to accommodate the installed cable plant plus 10 percent spares. Cable guides shall be provided above, below and between each panel.

3.1.6 Rack Mounted Equipment

Equipment to be rack mounted shall be securely fastened to racks by means of the manufacturer's recommended fasteners.

3.1.7 Spare Parts

The Contractor shall provide spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later than the start of the field tests.

3.2 TERMINATION

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. When there are multiple system type drops to individual workstations, relative position for each system shall be maintained on each system termination block or patch panel.

3.2.1 Unshielded Twisted Pair Cable

Each pair shall be terminated on appropriate outlets, terminal blocks or patch panels. No cable shall be unterminated or contain unterminated elements. Pairs shall remain twisted together to within the proper distance from the termination as specified in EIA ANSI/TIA/EIA-568-B. Conductors shall not be damaged when removing insulation. Wire insulation shall not be damaged when removing outer jacket.

3.3 GROUNDING

Signal distribution system ground shall be installed in the telecommunications entrance facility and in each telecommunications closet in accordance with EIA ANSI/TIA/EIA-607A and Section 16415A ELECTRICAL WORK, INTERIOR. Equipment racks shall be connected to the electrical safety ground.

3.4 ADDITIONAL MATERIALS

The Contractor shall provide the following additional materials required for facility startup.

- a. 10 of each type outlet.
- b. 10 of each type cover plate.
- c. 1 of each type terminal block for each telecommunications closet.
- d. 4 Patch cords of 3 m for each telecommunications closet.
- e. 1 Set of any and all special tools required to establish a cross connect and to change and/or maintain a terminal block.

3.5 ADMINISTRATION AND LABELING

3.5.1 Labeling

3.5.1.1 Labels

All labels shall be in accordance with EIA ANSI/TIA/EIA-606A.

3.5.1.2 Cable

All cables will be labeled using color labels on both ends with encoded identifiers per EIA ANSI/TIA/EIA-606A.

3.5.1.3 Termination Hardware

All workstation outlets and patch panel connections will be labeled using color coded labels with encoded identifiers per EIA ANSI/TIA/EIA-606A.

3.6 TESTING

Materials and documentation to be furnished under this specification are subject to inspections and tests. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests have been made in accordance with the approved Test Plan submitted by the Contractor, demonstrating that the signal distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided. The Contractor shall submit Test Reports as they are completed.

3.6.1 Unshielded Twisted Pair Tests

All metallic cable pairs shall be tested for proper identification and continuity. All opens, shorts, crosses, grounds, and reversals shall be corrected. Correct color coding and termination of each pair shall be verified in the communications closet and at the outlet. Horizontal wiring shall be tested from and including the termination device in the communications closet to and including the modular jack in each room. Backbone wiring shall be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective communications closets. These test shall be completed and all errors corrected before any other tests are started.

3.6.2 Category 6 Circuits

All category 6 circuits shall be tested using a test set that meets the Class II accuracy requirements of EIA TIA/EIA-TSB-67 standard, including the additional tests and test set accuracy requirements of EIA ANSI/TIA/EIA-568-B.2-1. Testing shall use the Basic Link Test procedure of EIA TIA/EIA-TSB-67, as supplemented by EIA ANSI/TIA/EIA-568-B.2-1. Cables and connecting hardware which contain failed circuits shall be replaced and retested to verify the standard is met.

3.6.3 Shielded Twisted Pair

Wiring configuration shall be tested for continuity, opens, shorts, swaps and correct pin configuration; dc resistance both pair-to-pair and wire-to-shield shall be verified. Cable lengths shall be verified. Near end crosstalk shall be tested from 772 kHz to 300 MHz. Ground potential difference between wiring closets, ground potential difference between patch panel and wall outlet, and ground path resistance shall be tested per IBM GA27-3361-07.

3.6.4 Coaxial Cable

Cable shall be tested for continuity, shorts and opens. Characteristic impedance shall be verified over the range of intended operation. Cable length shall be verified. Cable shall be sweep tested for attenuation over the range of intended operation.

3.6.5 Fiber Optic Cable

Unless stated otherwise, tests shall be performed from both ends of each circuit. Connectors shall be visually inspected for scratches, pits or chips and shall be reterminated if any of these conditions exist. Each circuit leg and complete circuit shall be tested for insertion loss at 850 and 1300 nm using a light source similar to that used for the intended communications equipment. High-resolution optical time domain reflectometer (OTDR) tests shall be performed from one end of each fiber. Scale of the OTDR trace shall be such that the entire circuit appears over a minimum of 80 percent of the X-axis.

-- End of Section --

SECTION 16711A

TELEPHONE SYSTEM, OUTSIDE PLANT
11/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C62.61 (1993) Gas Tube Surge Arresters on Wire
Line Telephone Circuits

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/TIA/EIA-607A (2002) Commercial Building Grounding
(Earthing) and Bonding Requirements for
Telecommunications

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2002) National Electrical Safety Code

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-85-625 (2002) Aircore, Polyolefin Insulated,
Copper Conductor Telecommunications Cable

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 345-50 (1979) Trunk Carrier Systems, PE-60

RUS 345-72 (1985) Filled Splice Closures (PE-74)

RUS Bull 1751F-635 (1996) Aerial Plant Construction

RUS Bull 1753F-201 (1997) Acceptance Test and Measurements of
Telecommunications Plant, PC-4

RUS Bull 1753F-205 (1993) Filled Telephone Cables, PE-39

RUS Bull 1753F-302 (1997) Outside Plant Housings and Serving
Area Interface Systems (PE-91)

RUS Bull 1753F-401	(1995) Splicing Copper and Fiber Optic Cables, PC-2
RUS IP 344-2	(2001) List of Materials Acceptable for Use on Telecommunications Systems of RUS Borrowers
RUS REA Bull 1751F-641	(1995) Construction of Buried Plant
RUS REA Bull 1753F-207	(1994) Terminating Cables, PE-87
RUS REA Bull 1753F-208	(1993) Filled Telephone Cables with Expanded Insulation , PE-89
RUS REA Bull 345-39	(1985) Telephone Station Protectors (PE-42)

UNDERWRITERS LABORATORIES (UL)

UL 497	(2001) Protectors for Paired Conductor Communication Circuits
UL 50	(1995; Rev thru Nov 1999) Enclosures for Electrical Equipment

1.2 SYSTEM DESCRIPTION

The outside plant system shall consist of all cable, conduit, manholes, poles, etc. required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards, terminating cables, lightning and surge protection modules at the entry facility. The work consists of furnishing, installing, testing and making operational a complete outside plant system for continuous use.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation

Detail drawings, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, and catalog cuts. Detail drawings shall also contain complete configuration information, wiring diagrams and any other details required to demonstrate that the cable system has been coordinated to support the transmission systems identified in the specifications and drawings. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other

parts of the work including clearance for maintenance and operations.

Record Drawings; G

Record drawings for the installed wiring system showing the actual location of all cable terminations, splices, routing, and size and type of all cables. The identifier for each termination and cable shall appear on the drawings. The drawings shall include gauge and pair or fiber count for each cable, duct and innerduct arrangement, or conductor assignment of outside plant, and protector and connector block layout at the termination points after installation.

SD-03 Product Data

Equipment

A data list of recommended spare parts, tools, and test equipment for each different item of material and equipment specified prior to beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

Installation; G

Printed copies of the manufacturer's recommendations for the material being installed, prior to installation. Installation of the item will not be allowed to proceed where installation procedures, or any part thereof, are required to be in accordance with those recommendations until the recommendations are received and approved.

Acceptance Tests; G

Test plans defining all tests required to ensure that the system meets specified requirements. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

Cutover and Records; G,

The cutover plan shall provide procedures and schedules for relocation of facility station numbers without interrupting service to any active location.

SD-06 Test Reports

Acceptance Tests

Test reports in booklet form showing all field tests performed, upon completion and testing of the installed system. Measurements shall be tabulated on a pair by pair or strand by strand basis.

SD-07 Certificates

Telephone System

Proof that the items furnished under this section conform to the specified requirements in FCC, ICEA, REA, RUS, ANSI, ASTM, NFPA, EIA, or UL, where materials and equipment are so specified.

Qualifications; G

The qualifications of the manufacturer, splicer, and installation supervisor as specified.

1.4 QUALIFICATIONS

1.4.1 Cable Installers

Installation shall be under the direct supervision of an individual with a minimum of 3 years experience in the installation of the specified copper cable and components.

1.4.2 Cable Splicing and Termination

All cable splicers shall have training in the proper techniques and have a minimum of 3 years experience in splicing and terminating the specified cables. Modular splices shall be performed by factory certified personnel or under direct supervision of factory trained personnel for products used.

1.4.3 Manufacturers

The cable, equipment, and hardware provided shall be from manufacturers that have a minimum of 3 years experience in producing the types of cable, equipment, and hardware specified.

1.5 DELIVERY AND STORAGE

1.5.1 Cable Requirements-

All cable shall be shipped on reels. The diameter of the drum shall be large enough to prevent damage to the cable during reeling and unreeling. The reels shall be constructed to prevent damage during shipment and handling. The outer end of the cable shall be securely fastened to the reel head to prevent the cable from becoming loose in transit. The inner end of the cable shall project into a slot in the side of the reel, or into a housing on the inner slot of the drum, with sufficient length to make it available for testing. The inner end shall be fastened to prevent the cable from becoming loose during installation. End seals shall be applied to each of the cables to prevent moisture from entering the cable. The reels with cable shall be suitable for outside storage conditions when the temperature ranges from minus 40 to plus 65 degrees C, with relative humidity from 0 to 100 percent.

1.5.2 Equipment

All equipment shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants, in accordance with the manufacturer's requirements.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 2 years prior to bid opening. Each major component of equipment shall have the manufacturer's name and type identified on the equipment. All products supplied shall be specifically designed and manufactured for use with outside plant communications systems. All items of the same class of equipment shall be the products of a single manufacturer.

2.2 CABLE

2.2.1 Copper Conductor Cable

Copper conductor cable shall conform to the following:

2.2.1.1 Aerial

- a. Lashed: RUS REA Bull 1753F-208.
- b. Self Supporting: ICEA S-85-625.

2.2.1.2 Direct Buried

Cable shall be manufactured per RUS REA Bull 1753F-208 or RUS REA Bull 345-39. A 0.2 mm coated aluminum or 0.12 mm copper metallic shield shall be provided.

2.2.1.3 Underground

Cable shall be manufactured per RUS Bull 1753F-205 or RUS REA Bull 1753F-208. A 0.2 mm coated aluminum or 0.12 mm copper metallic shield shall be provided.

2.2.1.4 Screened

Screened cable shall comply with RUS Bull 1753F-205 or RUS REA Bull 1753F-208.

2.3 CLOSURES

2.3.1 Copper Conductor Closures

2.3.1.1 Aerial Closure

The aerial closure shall be free breathing and suitable for housing straight and butt splices of non-pressurized communications cables. The closure shall be constructed with ultraviolet resistant PVC.

2.3.1.2 Buried Closure

Buried closure shall conform to RUS 345-72.

2.3.1.3 Underground Closure

Underground closures shall conform to RUS 345-72. The closure shall be of thermoplastic, thermoset, or stainless steel material and be suitable for use in a vault or manhole.

2.4 CABLE SPLICES AND ORGANIZERS

2.4.1 Copper Cable Splices

All cables greater than 25 pairs shall be spliced using modular splicing connectors, which accommodate 25 pairs of conductors at a time. The correct connector size shall be used to accommodate the wire gauge of the cable to be spliced. The connectors used shall be listed in RUS IP 344-2.

2.5 CABLE TERMINALS

2.5.1 Pedestal-Type Cable Terminals

Pedestal-type cable terminals shall conform to RUS Bull 1753F-302.

2.5.2 Cross-connect Cable Terminals

Cross-connect cable terminals shall be weatherproofed for outdoor use and suitable for pole, pad, or stake mounting. The terminal shall be equipped with mounting columns and distribution rings for jumper-wire routing. The terminal shall be of aluminum or steel construction and ribbed for strength.

2.6 EQUIPMENT RACKS

Distribution frames, cabinets, and back-boards shall be provided as shown and designed to mount connector blocks, protector blocks, cross connects, and other hardware required to terminate and protect the outside telephone plant cable; to provide a demarcation point between inside and outside plant cable; and to allow inside and outside plant cable to be cross connected.

2.6.1 Floor Mounted Open Frame

Floor mounted equipment racks shall be single sided welded steel relay

racks with uprights to mount equipment 480 mm wide. Uprights shall be 75 mm deep channel, 32 mm wide, drilled and tapped 12-24 in a 13 mm pattern.

Racks shall be provided with a standard top cross-member, and predrilled base plate to allow floor fastening. Open frame equipment racks shall be 2.1 m in height and painted ivory/off-white. AC outlets shall be provided as shown.

2.6.2 Wall Mounted Open Frame

Wall mounted open frame equipment racks shall be steel relay racks to mount equipment 480 mm wide with standoff brackets for wall mounting. Uprights shall be drilled and tapped 12-24 in a 13 mm pattern. Standoff brackets shall be of sufficient length for a 150 mm clearance between rack and wall. Wall mounted open frame racks shall be hinged. AC outlets shall be provided as shown.

2.6.3 Cable Guides

Cable guides shall be specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 480 mm equipment racks. Cable guides shall consist of ring or bracket-like devices mounted on rack panels for horizontal use or individually mounted for vertical use. Cable guides shall mount to racks by screws and/or nuts and lock-washers.

2.6.4 Floor Mounted Cabinets

Equipment cabinets shall be floor mounted enclosures with side panels, acrylic plastic front doors, rear louvered metal doors, depth-adjustable front and rear mounting rails, and louvered top. Ventilation fans shall be included. Vertical cable management devices shall be integral to the cabinet. Power strips with 12 outlets shall be mounted within the cabinet.

Equipment racks shall mount equipment 480 mm wide and shall be 1828 mm high and 760 mm deep. Cabinet exteriors shall be painted ivory/off-white.

2.6.5 Wall Mounted Cabinets

Wall mounted cabinets shall conform to UL 50 and have boxes constructed of zinc-coated sheet steel with dimensions not less than shown on drawings. Trim shall be fitted with hinged door and flush catch. Doors shall provide maximum openings to the box interiors. Boxes shall be provided with 19 mm plywood backboard painted white or a light color. A duplex AC outlet shall be installed within the cabinet.

2.6.6 Equipment Mounting Backboard

Backboards shall be 19 mm AC plywood, sized as shown, painted with white or light colored paint.

2.7 CONNECTOR BLOCKS

Connector blocks consisting of flame-retardant molded plastic fastened to a metal mounting bar shall be provided to terminate the outside plant cable as shown. The connector blocks shall be of 100-pair block size and

equipped with protection modules. The connector blocks shall be 24 gauge stub type. The cable stubs shall be 100 pair and conform to RUS REA Bull 1753F-207.

2.8 PROTECTOR MODULES

The protector modules shall be of the two-element gas tube type. Protection modules shall be heavy duty, $A > 10$ kA, $B > 400$, $C > 65A$ where A is the maximum single impulse discharge current, B is the impulse life and C is the AC discharge current per ANSI C62.61. The gas modules shall shunt high voltage to ground, fail short, be equipped with an external spark gap and heat coils, and shall comply with UL 497.

2.9 MISCELLANEOUS ITEMS

2.9.1 Cable Warning Signs

Cable warning signs, which identify the route of buried cable, shall be stake mounted. The stake shall be driven into undisturbed soil and the sign shall be mounted to the stake in accordance with the manufacturer's instructions. Warning signs shall be placed at intervals of no more than 152.5 m and at each change of direction in the cable route. Warning signs shall also be placed on each side of every crossing of surface obstacles such as roads, railroads, stream crossings, or any similar crossing where excavation is likely to occur.

PART 3 EXECUTION

3.1 INSTALLATION

All system components and appurtenances shall be installed in accordance with the manufacturer's instructions and as shown. All installation work shall be done in accordance with the safety requirements set forth in the general requirements of IEEE C2 and NFPA 70.

3.1.1 Cable Inspection and Repair

All cable and wire used in the construction of the project shall be handled with care. Each reel shall be inspected for cuts, nicks or other damage. All damage shall be repaired to the satisfaction of the Contracting Officer. The reel wrap shall remain intact on the reel until the cable or wire is ready to be placed.

3.1.2 Buried Cable

Buried cable installation shall be accomplished in accordance with RUS REA Bull 1751F-641.

3.1.2.1 Above Ground Cable Protection

Cable installed on the outside of buildings, less than 2.5 m above finished grade, shall be protected against physical damage.

3.1.2.2 Telephone Cable Bends

Telephone cable bends shall have a radius of not less than 10 times the cable diameter.

3.1.2.3 Penetrations

Penetrations in walls, ceilings or other parts of the building, made to provide for cable access, shall be caulked and sealed. Where conduits and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in Section 07840 FIRESTOPPING. Fire stopped penetrations shall not compromise the fire rating of the walls or floors. All underground building entries shall be through waterproof facilities.

3.1.2.4 Cable Protection

Unless otherwise shown or specified, direct buried cable shall be protected in accordance with Table 300.5 of NFPA 70. Where additional protection is required, cable may be placed in galvanized iron pipe (GIP) sized on a maximum fill of 40% of cross-sectional area, or in concrete encased 100 mm PVC pipe. Conduits shall extend at least 150 mm per 305 mm burial depth beyond the edge of the surface where cable protection is required; all conduits shall be sealed on each end. Conduit may be installed by jacking or trenching. Trenches shall be backfilled with earth and mechanically tamped at 150 mm lifts so that the earth is restored to the same density, grade and vegetation as adjacent undisturbed material.

3.1.3 Underground Cable

Underground cable installation shall be accomplished in accordance with the requirements set forth in RUS REA Bull 1751F-641.

3.1.3.1 Cable Pulling

For cable installed in ducts and conduit, a cable feeder guide shall be used, between the cable reel and the face of the duct and conduit, to protect the cable and guide it into the duct and conduit as it is paid off the reel. As the cable is paid off the reel, it shall be inspected for jacket defects. Precautions shall be taken during installation to prevent the cable from being kinked or crushed. A pulling eye shall be attached to the cable and used to pull the cable through the duct and conduit system. Cable shall be hand fed and guided through each manhole. As the cable is paid off the reel into the cable feeder guide, it shall be sufficiently lubricated with a type of lubricant recommended by the cable manufacturer. Where the cable is pulled through a manhole, additional lubricant shall be applied at all intermediate manholes. Dynamometers or load-tension instruments shall be used to ensure that the pulling line tension does not exceed the installation tension value specified by the cable manufacturer. The mechanical stress placed upon a cable during installation shall not cause the cable to be twisted or stretched.

3.1.3.2 Penetrations for Cable Access

Penetrations in walls, ceilings or other parts of the building, made to provide for cable access, shall be caulked and sealed. Where conduits and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in section 07840 FIRESTOPPING. Fire stopped penetrations shall not compromise the fire rating of the walls or floors. All underground building entries shall be through waterproof facilities.

3.1.3.3 Cable Bends

Telephone cable bends shall have a radius of not less than 10 times the cable diameter. Only large radius sweeps shall be used in conduit runs and shall not exceed a cumulative 90 degrees between manholes.

3.1.4 Aerial Cable

Aerial cable installation shall be accomplished in accordance with the requirements set forth in RUS Bull 1751F-635.

3.1.5 Surge Protection

All cables and conductors, which serve as communication lines, shall have surge protection meeting the requirements of RUS 345-50 installed at the entry facility.

3.2 SPLICING

3.2.1 Copper Conductor Splices

Copper conductor cable splicing shall be accomplished in accordance with RUS Bull 1753F-401. Modular splicing shall be used on all cables larger than 25 pairs.

3.3 GROUNDING

Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals shall be grounded. Grounding shall be in accordance with requirements of NFPA 70, Articles 800-33 and 800-40.

3.3.1 Ground Bars

3.3.1.1 Telecommunications Master Ground Bar (TMGB)

A copper TMGB shall be provided, in accordance with EIA ANSI/TIA/EIA-607A, to be the hub of the basic grounding system by providing a common point of connection for ground from outside cable, MDF, and equipment. The TMGB shall have a ground resistance, including ground, of 10 ohms or less.

3.3.1.2 Telecommunications Ground Bar (TGB)

Copper TGB shall be provided in accordance with EIA ANSI/TIA/EIA-607A in

each communications closet and room and each frame. The TGB shall be connected to the TMGB in accordance with EIA ANSI/TIA/EIA-607A. Each TGB shall be connected to the TMGB by the most direct route utilizing a copper wire conductor with a total resistance of less than 0.01 ohms.

3.3.2 Incoming Outside Plant Cables

All incoming outside plant cable shields shall be bonded directly to the TMGB or the closest TGB.

3.3.3 Cable Stubs

All shields of cable stubs shall be bonded to a TGB located on the frame.

3.3.4 Shields

The shields of all incoming cables shall not be bonded across the splice to the cable stubs.

3.3.5 Protection Assemblies

The protector assemblies shall be mounted directly on the vertical frame ironwork. The assemblies mounted on each vertical frame shall be connected with a No. 6 AWG copper conductor to provide a low resistance path to the TGB.

3.3.6 Manholes

The shields of all cables in each manhole shall be bonded together by a bonding wire or ribbon. At intermediate manholes, where the cable is pulled through without a sheath opening, bonds are not required. If the manhole has a lacerating bonding ribbon, the shields of spliced cables shall be attached to it.

3.4 CUTOVER AND RECORDS

All necessary transfers and cutovers, shall be accomplished by the Contractor.

3.5 ACCEPTANCE TESTS

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test; testing shall not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. The test plans shall define all the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

3.5.1 Copper Conductor Cable

The following acceptance tests shall be performed in accordance with RUS Bull 1753F-201:

- a. Shield continuity.
- b. Conductor continuity.
- c. Conductor insulation resistance.
- d. Structural return loss.
- e. Cable insertion loss and loss margin at carrier frequencies.
- f. Shield ground for single jacketed cables.
- g. DC loop resistance.

-- End of Section --

SECTION 16713N

FIBER OPTIC (FO) OUTSIDE PLANT (OSP)
02/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/TIA/EIA-568-A	(1995; Addendum 3 1998) Commercial Building Telecommunications Cabling Standard - 3 Parts
EIA EIA/TIA-455-59	(1989) Measurement of Fiber Point Defects Using an OTDR
EIA EIA/TIA-455-78A	(1990; R 1998) Spectral-Attenuation Cutback Measurement for Single-Mode Optical Fibers
EIA TIA-758	(1999) Customer-owned Outside Plant Telecommunications Cabling Standard, including Addendum No. 1
EIA TIA/EIA-455-107A	(1999) Component Reflectance or Link/System Return Loss using a Loss Test Set
EIA TIA/EIA-455-B	(1998) Test Procedures for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components (ANSI)
EIA TIA/EIA-472D000-A	(1993) Fiber Optic Communications Cable for Outside Plant Use
EIA TIA/EIA-472DAAA	(1993) Detail Specification for All Dielectric Fiber Optic Communications Cable for Outside Plant Use Containing Class 1a 62.5 Um Core Diameter/125 um Cladding Diameter/250 um Coating Diameter Fiber(s).
EIA TIA/EIA-4750000-C	(1996) Generic Specifications for Fiber Optic Connectors (ANSI)
EIA TIA/EIA-526-14A	(1998) OFSTP-14A Optical Power Loss

	Measurements of Installed Multimode Fiber Cable Plant (ANSI/TIA/EIA-526-14A)
EIA TIA/EIA-526-7	(1998) OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (ANSI/TIA/EIA-526-7)
EIA TIA/EIA-568-B.1	(2001; Addendum 2001) Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements (ANSI/TIA/EIA-568-B.1)
EIA TIA/EIA-568-B.3	(2000; Addendum 2002) Optical Fiber Cabling Components Standard (ANSI/TIA/EIA-568-B.3)
EIA TIA/EIA-569-A	(1998; Addenda 2000, 2001) Commercial Building Standards for Telecommunications Pathways and Spaces (ANSI/TIA/EIA-569-A)
EIA TIA/EIA-590-A	(1997) Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant
EIA TIA/EIA-598-B	(2001) Optical Fiber Cable Color Coding
EIA TIA/EIA-604-3A	(2000) FOCIS 3 Fiber Optic Connector Intermateability Standard - Standard Type SC

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2002) National Electrical Safety Code
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INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-87-640	(1999) Fiber Optic Outside Plant Communications Cable
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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1997) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA RN 1	(1998) Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(2003) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit
NEMA TC 3	(1999) PVC Fittings for Use with Rigid PVC Conduit and Tubing

NEMA TC 6 & 8 (1999) PVC Plastic Utilities Duct for Underground Installations

NEMA TC 9 (1999) Fittings for PVC Plastic Utilities Duct for Underground Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 7CFR 1755.900 (2000) Filled Fiber Optic Cables (REA)

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-188-176 (Basic, Notice 1) Standardized Profile for Asynchronous Transfer Mode (ATM)

MIL-STD-2042 (Rev B) Fiber Optic Cable Topology Installation Standard Methods for Naval Ships

UNDERWRITERS LABORATORIES (UL)

UL 50 (1995; Rev thru Nov 1999) Enclosures for Electrical Equipment

1.2 SYSTEM DESCRIPTION

The outside plant system shall consist of all cable, conduit, manholes, poles, etc. required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards, and terminating cables at the entry facility. The work consists of furnishing, installing, testing and making operational a complete outside plant system for continuous use.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fiber Optic System; G

SD-03 Product Data

Fiber Optic Media Types; G

Fiber Optic Splices Material Data; G

Fiber Optic Terminations and Connectors Material Data; G

Fiber Optic Enclosures; G

SD-06 Test Reports

Fiber Optic Factory Test Plan; G

Fiber Optic Field Tests Plan; G

SD-07 Certificates

Fiber Optic Cable Installer and Splicer Qualifications; G

Manufacturer's qualifications; G

SD-08 Manufacturer's Instructions

Fiber optic system instructions; G

1.4 QUALITY ASSURANCE

1.4.1 Fiber Optic System

Provide drawings for the fiber optic cable and pathway system. Provide single line schematic details of the fiber optic and pathway media, splices, and associated construction materials. Drawings shall be in AUTOCAD.DXF or compatible format. Provide Registered Communications Distribution Designer (RCDD) approved drawings of the fiber optic system. Include drawing details of fiber optic terminations in equipment rooms. System drawings shall show final configuration, including location, fiber pair count, pathway innerduct arrangement, and pathway assignment of outside plant. FO system shall be compatible with MIL-STD-188-176. Pier FO systems shall be designed for compatibility with MIL-STD-2042 and NAVSEA drawings.

1.4.2 Fiber Optic Cable Installer and Splicer Qualifications

Technicians installing FO media, splices and performing system tests shall be certified and trained in accordance with an approved manufacturers training program. Technicians shall have a minimum of 3 years FO experience in installing equivalent FO systems. Submit data for approval to the Contracting Officer. Submit FO technician qualifications for approval 30 days before splices are to be made on the cable. Certification shall include the training, and experience of the individual on specific type and classification of FO media to be provided under this contract.

1.4.3 Fiber Optic System Instructions

Provide installation methods and procedures for installing the FO media and pathway system. Include methods and procedures for installing FO media, pathway, splices, and associated hardware. Submit installation procedures and equipment list to the Contracting Officer.

1.4.4 Manufacturer's Qualifications

The FO media manufacturer shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of FO media which comply with RUS 7CFR 1755.900. Manufacturer must provide a list of customers with 3 years of maintenance logs documenting experience with government customers.

1.4.5 Fiber Optic Factory Test Plan

Prepare and provide the government for review a test plan for factory and field tests of the FO media. Provide factory OTDR test data as part of the test report. Provide a list of factory test equipment. Include a FO link performance test plan. Submit the plan at least 30 days prior to tests for government approval. Refer to EIA TIA/EIA-569-A for performance measurement criteria. Conduct tests at all operating bandwidths. Provide calculations for optical power budget and bandwidth as required by RUS 7CFR 1755.900 using test method EIA EIA/TIA-455-78A or EIA TIA/EIA-455-B. Submit test plans and reports to the government for review and approval.

1.4.6 Fiber Optic Field Tests Plan

Prepare and provide technicians and test equipment for field tests of FO media. Conduct OTDR reel tests at the job site prior to installation. Perform OTDR and end to end tests of all installed media. Conduct tests on single mode fiber in accordance with EIA TIA/EIA-526-7 for single mode fiber and EIA TIA/EIA-526-14A for multi mode fiber.

1.5 DELIVERY, STORAGE, AND HANDLING

Ship media to job site on factory reels or in factory cartons. Radius of the reel drum shall not be smaller than the minimum bend radius recommended by the manufacturer for the media. Wind cable on the reel so that unwinding can be done without kinking the cable. Two meters of cable at each end of the reel must be readily accessible for testing. Provide a permanent label on each reel showing length, media, identification number, and date of manufacture. Provide water resistant label and ink on the labels. Apply end seals to each end of the media after testing and before terminating to prevent moisture from entering the cable while stored at the job site. Reels with cable shall be suitable for outside storage conditions when temperature ranges from minus 40 degrees C to plus 65 degrees C, with relative humidity from zero to 100 percent. Equipment, other than FO media, delivered and placed in storage shall be stored with protection from weather, humidity and temperature variation, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and FO system material shall be the standard products of a manufacturer regularly engaged in the manufacturer of such products and shall be the manufacturer's standard commercially available product.

2.1.1 Fiber Optic Media Types

FO media shall meet all performance requirements of EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.3 and the physical requirements of ICEA S-87-640 and EIA TIA/EIA-598-B.

2.1.1.1 Multi Mode Fiber Media

Provide FO media with outer sheath jacket, strength member, ripcords, water blocking material, optional steel shield, core tube, and core fibers as installed in a permanent underground pathway system as shown on the construction drawings. FO media shall have an all glass, graded index material with a nominal core diameter of 62.5 microns. Provide a cladding material for the fiber which is compatible with the core. Media transmission window shall be centered at 850 and 1300 nanometer wavelengths, attenuation at 1300 nanometers shall be less than 2.0 dB per kilometer. Minimum bandwidth shall be 500 MHz-Km.

2.1.1.2 Single Mode Fiber Media.

Provide FO single mode media with outer sheath jacket, strength member, ripcords, water blocking material, optional steel shield, core tube, and core fibers as installed in a permanent underground pathway system as shown on the construction drawings. Media shall have all glass, dual window, graded index material with a core diameter of 8.7 microns. Fiber shall be coated with a cladding material which is concentric with the core. Fiber cladding diameter shall be nominal 125 microns. Media shall have a transmission window centered at 1300 and 1550 nanometer wavelengths, attenuation at 1550 nanometers shall be less than 0.5 dB per kilometer. FO media shall comply with EIA TIA/EIA-472DAAA, and EIA TIA-758.

2.2 FIBER OPTIC SPLICES

Provide FO splices and splicing materials for fusion methods at locations shown on the construction drawings. The splice insertion loss shall be less than 0.1 dB mean, (0.3 dB max) when measured in accordance with EIA EIA/TIA-455-59 using an Optical Time Domain Reflectometer (OTDR). Splices shall be designed for a return loss of 40.0 db max for single mode fiber when tested in accordance with EIA TIA/EIA-455-107A.

2.3 FIBER OPTIC ENCLOSURES

Provide metallic enclosures for fiber optic data transmission equipment. NEMA 250, type 4 enclosure. Enclosures shall protect the spliced fibers from moisture and physical damage. Splice closure shall provide strain relief for the cable and the fibers at splice points. Provide full documentation citing conformance to structural parameters.

2.4 FIBER OPTIC TERMINATIONS AND CONNECTORS

FO connectors shall comply with EIA TIA/EIA-4750000-C and EIA TIA/EIA-604-3A.

2.5 FIBER OPTIC PATHWAY SYSTEM

Provide an FO pathway system including raceway conduit, duct system, at roadway crossings. Pathway materials shall comply with EIA TIA/EIA-569-A, and the following commercial standards for construction materials, NEMA RN 1 (PVC), NEMA TC 2 (PVC), NEMA TC 3 (PVC), NEMA TC 6 & 8, and NEMA TC 9.

2.6 FACTORY FO QUALITY CONTROL

Conduct factory quality tests of FO media as required by EIA TIA/EIA-472D000-A.

2.7 PREPARATION FOR DELIVERY

Ship media on reels in lengths to eliminate splicing. Provide 2 meters pigtails on each end of media accessible for testing. Reel drum shall comply with manufacturers recommended bend radius for the media. Wind media on reel so that unreeling can be done without kinking the media. Attach a permanent waterproof label with indelible text on reel showing the length, media type, bandwidth, attenuation, and date of manufacture.

2.8 FACTORY REEL TEST

Test 100 percent OTDR test of FO media at the factory prior to shipment in accordance with EIA TIA/EIA-568-B.1 and EIA TIA/EIA-568-B.3. Use EIA TIA/EIA-526-7 for single mode fiber and EIA TIA/EIA-526-14A Method B for multi mode fiber measurements. Calibrate OTDR to show anomalies of 0.2 dB minimum. Provide digitized or photographic traces to the Contracting Officer.

2.9 MISCELLANEOUS ITEMS

2.9.1 FO Media Tags

Provide stainless steel, 41.25 mm in diameter 1.58 mm thick, and circular in shape.

2.9.2 Grounding Braid

Grounding braid shall provide low electrical impedance connections for dependable shield bonding. Braid shall be made from flat tin-plated copper.

2.10 FIBER-OPTIC TERMINATIONS

2.10.1 Fiber Optic Connectors

All outside plant fiber strands shall be terminated in a SC type fiber optic connector, with ceramic ferrule material and a maximum insertion loss of 0.5 dB. Connectors shall meet performance standards of EIA ANSI/TIA/EIA-568-A. If pre-connectorized cable assemblies or pigtails are used, the connectors shall be terminated on a 3 m length of single-fiber cable. The single-fiber cable shall contain a buffered optical fiber of the same type and specification as that used in the multi-fiber cable.

2.10.2 Fiber Optic Patch Panels

Patch panels shall be a complete system of components by a single manufacturer, and shall provide termination, splice storage, routing, radius limiting, cable fastening, storage, and cross-connection. Patch panels shall be 480 mm rack mounted panels. Patch panels shall provide strain relief for cables. Panels shall be labeled with alphanumeric x-y coordinates. Patch panel connectors and couplers shall be the same type and configuration as used elsewhere in the system.

2.11 EQUIPMENT RACKS

Distribution frames, cabinets, and back-boards shall be provided and designed to mount connector blocks, protector blocks, cross connects, and other hardware required to terminate and protect the outside plant fiber cable; to provide a demarcation point between inside and outside plant cable; and to allow inside and outside plant cable to be cross connected.

2.11 Floor Mounted Open Frame

Floor mounted equipment racks shall be single sided, welded steel relay racks with uprights to mount equipment 480 mm wide. Uprights shall be 75 mm deep channel, 32 mm wide, drilled and tapped 12-24 in a 13 mm pattern.

Racks shall be provided with a standard top cross-member, and predrilled base plate to allow floor fastening. Open frame equipment racks shall be 2.1 m in height and painted ivory/off-white. AC outlets shall be provided as shown.

2.12 Wall Mounted Open Frame

Wall mounted open frame equipment racks shall be steel relay racks to mount equipment 480 mm wide with standoff brackets for wall mounting. Uprights shall be drilled and tapped 12-24 in a 13 mm pattern. Standoff brackets shall be of sufficient length for a 150 mm clearance between rack and wall. Wall mounted open frame racks shall be hinged. AC outlets shall be provided as shown.

2.13 Cable Guides

Cable guides shall be specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 480 mm equipment racks. Cable guides shall consist of ring or bracket-like devices mounted on rack panels for horizontal use or individually mounted for vertical use. Cable guides shall mount to racks by screws and/or nuts and lock-washers.

2.14 Floor Mounted Cabinets

Equipment cabinets shall be floor mounted enclosures with side panels, acrylic plastic front doors, rear louvered metal doors, depth-adjustable front and rear mounting rails, and louvered top. Ventilation fans shall be included. Vertical cable management devices shall be integral to the cabinet. Power strips with 12 outlets shall be mounted within the cabinet.

Equipment racks shall mount equipment 480 mm wide and shall be 1828 mm

high and 760 mm deep. Cabinet exteriors shall be painted ivory/off-white.

2.15 Wall Mounted Cabinets

Wall mounted cabinets shall conform to UL 50 and have boxes constructed of zinc-coated sheet steel. Trim shall be fitted with hinged door and flush catch. Doors shall provide maximum openings to the box interiors. Boxes shall be provided with 19 mm plywood backboard painted white or a light color. A duplex AC outlet shall be installed within the cabinet.

2.11.6 Equipment Mounting Backboard

Backboards shall be 19 mm AC plywood, sized as shown, painted with white or light colored paint.

PART 3 EXECUTION

3.1 INSTALLATION

Install and test the FO media in accordance with contract drawings, specifications, IEEE C2, NFPA 70, and EIA TIA/EIA-590-A. Provide all necessary power, utility services, technicians, test equipment, calibration equipment as required to perform reel and final acceptance tests of the media. All media which fail the factory or reel tests or final acceptance field tests shall be replaced and re-tested at the contractors expense. Splices are not permitted unless shown on the construction drawings. Field test splices within 24 hours after splice installation. Splices shall be tested to demonstrate a maximum 0.2 dB loss. Provide a splice box for each field splice. Provide a minimum of 2 meters for routing and testing media. Protect media ends of unspliced FO media during splicing operations.

3.1.1 Contractor Damage

Promptly repair indicated utility and communications lines or systems damaged during site preparation and construction. Damage to lines or systems not indicated, which are caused by contractor operations, shall be treated as "Changes" under the terms of the Contract clauses. When Contractor is advised in writing of the location of a non-indicated line or system, such notice shall provide that portion of the line or system with "indicated" status in determining liability for damages. In every event, immediately notify the Contracting Officer of damage.

3.1.2 Roadway Crossings

Installation shall be in accordance with EIA TIA/EIA-590-A. Under roadways install cable in conduit. Slope ducts to drain. Excavate trenches by hand or mechanical trenching equipment. Provide a minimum cable cover of 610 mm below finished grade. Trenches shall be not less than 155 mm wide and in straight lines between cable markers. Do not use cable plows. Bends in trenches shall have a radius of not less than 915 mm. Where two or more cables are laid parallel in the same trench, space laterally at least 75 mm apart. When rock is encountered, remove it to a depth of at least 75 mm below the cable and fill the space with sand or clean earth free from particles larger than 6 mm. Do not unreel and pull

cables into the trench from one end. Cable may be unreeled on grade and lifted into position. Provide FO media tags at crossings.

3.1.2.1 Media Placement

- a. Separate FO media crossing other cables or metal piping from the other cables or pipe by not less than 75 mm of well tamped earth. Do not install FO media under or above traffic signal loops.
- b. Media shall be in one continuous length without splices except where splices are shown on the drawings.
- c. Do not allow bends in media which exceed the manufacturers minimum recommended radii. Do not bend media to a radius less than 10 times the outside diameter of the media.
- d. Leave a horizontal slack of approximately 915 mm in the ground on each end of cable runs, on each side of connection boxes, and at points where connections are brought above ground. Where cable is brought above ground, leave additional slack to make necessary connections.

3.1.2.2 Identification Slabs (Markers)

Provide a marker at each change of direction of the cable, over the ends of ducts or conduits which are installed under paved areas and roadways and over each splice. Identification markers shall be of concrete, approximately 500 mm square by 150 mm 6 inches thick and stake mounted warnings meeting the requirements of REA.

3.1.3 Reconditioning of Surfaces

3.1.3.1 Unpaved Surface Treatment

Restore unpaved surfaces disturbed during the installation of duct or direct burial cable to their original elevation and condition. Carefully preserve existing sod and topsoil and replace after the back-filling is completed. Replace damaged sod with sod of quality equal to that removed. Where the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding.

3.1.3.2 Paving Repairs

Where trenches, pits, or other excavations are made in existing roadways and in other areas of pavement where surface treatment of any kind exists, restore such surface treatment or pavement to the same thickness and to the same kind as previously existed. Surface treatment or pavement shall also match and tie into the adjacent and surrounding existing surfaces.

3.1.4 Cable Pulling

Test duct lines with a mandrel and swab out to remove foreign material before the pulling of FO media. Avoid damage to cables in setting up

pulling apparatus or in placing tools or hardware. Do not step on media when entering or leaving the maintenance holes. Do not place media in ducts other than those shown without prior written approval of the Contracting Officer. Roll cable reels in the direction indicated by the arrows painted on the reel flanges. Set up media reels on the same side of the maintenance hole as the pathway section in which the media is to be placed. Level the reel and bring into proper alignment with the pathway section so that the media pays off from the top of the reel in a long smooth bend into the duct without twisting. Under no circumstances shall the media be paid off from the bottom of the reel. Check the equipment set up prior to beginning the media cable pulling to avoid an interruption once pulling has started. Use a cable feeder guide of suitable dimensions between media reel and face of duct to protect media and guide cable into the duct as it is paid off the reel. As media is paid off the reel, lubricate and inspect media for sheath defects. When defects are noticed, stop pulling operations and notify the Contracting Officer to determine required corrective action. Stop media pulling if reel binds or does not pay off freely. Rectify cause of binding before resuming pulling operations. Provide media lubricants recommended by the cable manufacturer. Provide 1 meter of spare media in all manholes and enclosures for final termination and testing.

3.1.4.1 FO Media Tensions

Route FO media as shown on construction drawings. Provide devices to monitor media tension during installation. Do not exceed manufacturers recommended maximum FO tensions and bending radii during installation.

3.1.4.2 Pulling Eyes

Equip media 30 mm in diameter and larger with cable manufacturer's factory installed pulling-in eyes. Provide media with diameter smaller than 30 mm with heat shrinkable type end caps or seals on cable ends when using cable pulling grips. Rings to prevent grip from slipping shall not be beaten into the cable sheath. Use a swivel grip of 19 mm links between pulling-in eyes or grips and pulling strand.

3.1.4.3 Installation of Media in Maintenance Manholes, Handholes, and Vaults

Do not install media utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support media on brackets and cable insulators at a maximum of 1220 mm. In existing maintenance manholes, handholes, and vaults where new ducts are to be terminated, or where new media are to be installed, modify the existing installation of media, cable supports, and grounding as required with cables arranged and supported as specified for new media.

3.1.5 Grounding

Ground exposed non current carrying metallic parts of telephone equipment, media sheaths, media splices, and terminals.

3.1.6 Housekeeping

The Contractor shall be responsible for cleaning up work area and maintaining the work area in orderly condition.

3.2 FIELD QUALITY CONTROL

Provide the Contracting Officer 10 working days notice prior to each reel and final acceptance test. Provide labor, equipment, and incidentals required for testing. Correct defective material and workmanship disclosed as the results of the tests. Furnish a signed copy of the test results to the Contracting Officer within 3 working days after the tests for each segment of construction are completed. Perform testing as construction progresses and do not wait until all construction is complete before starting field tests.

3.2.1 Field Reel Tests

Perform the following tests on FO media at the job site before it is removed from the cable reel. For cables with factory installed pulling eyes, these tests shall be performed at the factory and certified test results shall accompany the media. Perform OTDR tests with media on reels and compare factory and field test data.

3.2.1.1 Reel Test Results

Provide results of reel tests to the Contracting Officer at least 5 working days before installation is to commence. Results shall indicate reel number of the media, manufacturer, type and number of fiber tested, and recorded readings. When reel tests indicate that the media does not comply with factory reel test results remove the media from the job site and replace with compliant media.

3.2.2 Final Acceptance Tests

Perform end-to-end tests including power meter light source and OTDR tests.

Perform OTDR measurements as required by EIA TIA/EIA-568-B.1 and EIA TIA/EIA-568-B.3. Single mode fiber shall be tested in accordance with EIA TIA/EIA-526-7 (Optical Power Loss). Multi mode fiber shall be tested in accordance with EIA TIA/EIA-526-14A (Optical Power Loss).

3.2.2.1 Test Results

Provide results of final acceptance tests (attenuation tests, OTDR traces, etc.), to the Contracting Officer at least 5 working days after completion of tests.

-- End of Section --

SECTION 16770

RADIO AND PUBLIC ADDRESS SYSTEMS

11/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/EIA-310-D (1992) Racks, Panels, and Associated Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991) Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1449 (1996; Rev thru Jul 2002) Transient Voltage Surge Suppressors

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

Detail drawings as specified.

SD-03 Product Data

Spare Parts

Spare parts data for each different item of material and

equipment specified.

SD-06 Test Reports

Approved Test Procedures; G

Test plan and test procedures for the acceptance tests. The test plan and test procedures shall explain in detail, step-by-step actions and expected results to demonstrate compliance with the requirements specified. The procedure shall also explain methods for simulating the necessary conditions of operation to demonstrate system performance.

Acceptance Tests

Test reports in booklet form showing all field tests performed to adjust each component and to prove compliance with the specified performance criteria, upon completion and testing of the installed system. The reports shall include the manufacturer, model number, and serial number of test equipment used in each test. Each report shall indicate the final position of controls and operating mode of the system.

SD-07 Certificates

Components

Copies of current approvals or listings issued by UL, or other nationally recognized testing laboratory for all components.

SD-10 Operation and Maintenance Data

Radio and Public Address System

Submit Data Package 3 in accordance with Section 01781 OPERATION AND MAINTENANCE DATA

1.3 SYSTEM DESCRIPTION

The radio and public address system shall consist of an audio distribution network to include amplifiers, mixers, microphones, speakers, cabling, and ancillary components required to meet the required system configuration and operation.

1.3.1 Single-Channel System

The system shall control and amplify an audio program for distribution within the areas indicated. Components of the system shall include a mixer-preamplifier, power amplifier, microphone, speaker system, cabling and other associated hardware.

1.3.2 System Performance

The system shall provide even sound distribution throughout the designated

area, plus or minus 3 dB for the 1/1 octave band centered at 4000 Hz. The system shall provide uniform frequency response throughout the designated area, plus or minus 3 dB as measured with 1/3-octave bands of pink noise at locations across the designated area selected by the Contracting Officer. The system shall be capable of delivering 75 dB average program level with additional 10 dB peaking margin sound pressure level (SPL) in the area at an acoustic distortion level below 5 percent total harmonic distortion (THD). Unless otherwise specified the sound pressure reference level is 20 micro Pascal (0.00002 Newtons per square meter).

1.3.3 Detail Drawings

The Contractor shall submit detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical speakers. The Contractor shall check the layout based on the actual speakers to be installed and make necessary revisions in the detail drawings. Detail drawings shall also contain complete point to point wiring, schematic diagrams and other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

1.3.4 Spare Parts

The Contractor shall submit spare parts data for each different item of material and equipment specified, after approval of the detail drawings and not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

1.4 DELIVERY AND STORAGE

Equipment placed in storage until installation shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants.

1.5 VERIFICATION OF DIMENSIONS

The Contractor shall become familiar with the details of the work and working conditions, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancies before performing the work.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Material and equipment to be provided shall be the standard products of a manufacturer regularly engaged in the manufacture of such products, and shall essentially duplicate material and equipment that have been in satisfactory use at least 2 years. All components used in the system shall be commercial designs that comply with the requirements specified.

Equipment shall be supported by a service organization that is within 8,000 miles of the site.

2.1.1 Identical Items

Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components.

2.1.2 Nameplates

Each major component of equipment shall have the manufacturer's name, address, model and catalog number, and serial number on a plate secured to the equipment.

2.2 MIXER-PREAMPLIFIER

Mixer-preamplifier shall as a minimum conform to the following specifications:

Rated Output:	18 dB
Frequency Response:	Plus or Minus 1 dB, 20 - 20,000 Hz
Distortion:	Less than 0.5 percent, 20 - 20,000 Hz
Signal to noise:	Microphone - 60 dB Aux - 70 dB
Inputs:	5 independent balanced low- impedance transformer-isolated
Input Sensitivity:	Microphone - 0.003 volts Aux - 0.125 volts Magnetic Cartridge - 0.0005 volts
Input Channel Isolation:	80 dB minimum
Tone Controls:	Plus or Minus 10 dB range at 50 and 15,000 Hz
Power Requirement:	110-125 Vac 60 Hz

2.3 POWER AMPLIFIERS

Power amplifiers as a minimum conform to the following specifications:

Rated power output:	250 watts RMS
Frequency Response:	Plus or Minus 3 dB, 20-20,000 Hz
Distortion:	Less than 2 percent at RPO, 600-13,000 Hz
Input Impedance:	50 k ohm unbalanced

Output Impedance: Balanced 4 and 8 ohms

Output voltage: 25 and 70.7 volts

Power Requirement: 110-125 Vac 60 Hz

2.4 MICROPHONES

2.4.1 Desk Microphone

Microphones shall as a minimum conform to the following specifications:

Element: Dynamic

Pattern: Cardioid

Frequency Response: 50 - 12,000 Hz

Impedance: Low impedance mic (150-400 ohms)

Front-to-back Ratio: 20 dB

Selector switches: Selector switches for zone shall be
be integral microphone or Separate
console adjacent to microphone

2.4.2 Gooseneck Microphone

Gooseneck microphone shall meet the minimum requirements of the desk microphone. Microphone shall have push to talk button. Gooseneck tube length shall be 305 mm .

2.4.3 Microphone Jack

Each outlet for microphones shall consist of a standard outlet box, flush-mounted, and fitted with a three-pole, polarized, locking-type, female microphone jack and a corrosion resistant-steel device plate.

2.5 LOUDSPEAKERS

2.5.1 Cone Speaker

The cone speaker shall as a minimum conform to the following specifications:

Application: Ceiling

Frequency range: 60 to 12,000 Hz

Power Rating: Normal - 7 watts
Peak - 10 watts

Voice Coil Impedance: 8 ohms

Line Matching

Transformer Type:	25/ 70.7 volt line
Capacity:	4 watts
Magnet:	10 ounces or greater
Primary Taps:	0.5, 1, 2 and 4 watts
Primary Impedance:	25 volts - 1250, 625, and 312 ohms 70.7 volts - 10k, 5k, and 2.5k ohms
Frequency Response:	30 - 20,000 Hz
Insertion Loss:	Less than 1 dB

2.5.2 Ceiling Speaker Enclosures

Ceiling speaker enclosure shall be constructed of heavy gauge cold steel with interior undercoating and 38 mm thick high density fiberglass 24 kg per cubic meter . The unit shall be round and designed for recessed installations which will be accomplished via standard screw mounting. Recessed models shall have a rust-preventive, textured black coating and the surface mount unit finished in textured white. Enclosure shall include four triple compound conduit knockouts.

2.6 SPEAKER SWITCHING PANEL

2.6.1 Selector Switches

Zone control shall be provided for the paging function. The speaker switching panel shall contain at least push button selector switches and shall be rack-mounted to activate priority relays. Selector switches labeling shall be provided to identify the zones.

2.6.2 System Power supply

Power supply shall be provided for priority relays and controls, rack-mounted and sized for a capacity equal to 200 percent of the as-built control system, and shall operate at 24 Vdc. Input and output shall be protected to permit Class 2 wiring in accordance with NFPA 70.

2.7 EQUIPMENT RACKS

Equipment shall be mounted on 482.6 mm racks in accordance with EIA ANSI/EIA-310-D and located as shown on drawings. Ventilated rear panels, solid side panels, and solid top panels shall be provided. Equipment racks shall be provided with lockable front panels that limit access to equipment. The lockable front shall not cover items that require operator access . Rack cooling shall be through top rack mounted fan. The racks and panels shall be factory finished with a uniform baked enamel over rust inhibiting primer.

2.8 CABLES

2.8.1 Speaker Cable

Cables shall be of the gauge required depending upon the cable run length. In no case shall cable be used which is smaller than 18 AWG. Insulation on the conductors shall be polyvinyl chloride (PVC) or an equivalent synthetic thermoplastic not less than 0.2 mm . Cables shall be jacketed with a compound suitable for use in cable tray. The jacket thickness shall be 0.5 mm minimum.

2.8.2 Microphone Cable

Cable conductor shall be stranded copper 20 AWG. Insulation on the conductors shall be polyvinyl chloride (PVC) or an equivalent synthetic thermoplastic not less than 0.2 mm . Cable shall be shielded 100% of aluminum polyester foil with a bare 22 gauge stranded soft copper drain conductor. Cables shall be jacketed with a PVC compound. The jacket thickness shall be 0.5 mm minimum.

2.9 TERMINALS

Terminals shall be solderless, tool-crimped pressure type.

2.10 SURGE PROTECTION

2.10.1 Power Line Surge Protection

Major components of the system such as power amplifiers, mixer-preamplifiers, and tuners, shall have a device, whether internal or external, which provides protection against voltage spikes and current surges originating from commercial power sources per IEEE C62.41 B3 combination waveform and NFPA 70. Fuses shall not be used for surge protection. The surge protector shall be rated for a maximum let thru voltage of 350 Volts ac (line-to-neutral) and 350 Volt ac (neutral-to-ground). Surge protection device shall be UL listed and labeled as having been tested in accordance with UL 1449.

2.10.2 SIGNAL SURGE PROTECTION

Major components of the system shall have internal protection circuits which protects the component from mismatched loads, direct current, and shorted output lines. Communication cables/conductors shall have surge protection installed at each point where it exits or enters a building.

2.11 TELEPHONE INTERFACE MODULE

Telephone Interface module shall provide one way all call paging access from telephone to PA system. Paging shall be accomplished by the building telephone system instruments interconnected to the PA system via an interface module to allow telephone dial up access to the paging amplifier.

Interface module shall produce an alert tone in the associated speakers on activation. Telephone interface module shall as a minimum conform to the

following specifications:

Impedance:	600 ohms
Frequency response:	100Hz to 10Khz
70V Input Impedance:	200K ohms
Output level:	400mV rms
Input Power Requirement:	12-24Vdc (from power supply)
Access requirement:	Electronic (analog) or IA2 line key (line card required) PABX loop or ground-start trunk port, or dedicated single-line phone.

PART 3 EXECUTION

3.1 INSTALLATION

Equipment shall be installed as indicated and specified, and in accordance with the manufacturer's recommendations except where otherwise indicated. Equipment mounted out-of-doors or subject to inclement conditions shall be weatherproofed.

3.1.1 Equipment Racks

Racks shall be mounted side-by-side and bolted together. Items of the same function shall be grouped together, either vertically or side-by-side. Controls shall be symmetrically arranged at a height as shown. Audio input and interconnections shall be made with approved shielded cable and plug connectors; output connections may be screw terminal type. All connections to power supplies shall utilize standard male plug and female receptacle connectors with the female receptacle being the source side of the connection. Inputs, outputs, interconnections, test points, and relays shall be accessible at the rear of the equipment rack for maintenance and testing. Each item shall be removable from the rack without disturbing other items or connections. Empty space in equipment racks shall be covered by blank panels so that the entire front of the rack is occupied by panels.

3.1.2 Wiring

Wiring shall be installed in rigid steel conduit, intermediate metal conduit, cable trays, or electric metallic tubing as specified in Section 16415A ELECTRICAL WORK, INTERIOR. Wiring for microphone, grounding, line level, speaker and power cables shall be isolated from each other by physical isolation and metallic shielding. Shielding shall be terminated at only one end.

3.2 GROUNDING

All grounding practices shall comply with NFPA 70. Equipment shall be grounded to the serving panelboard ground bus through a green grounding conductor. Metallic conduits serving the equipment shall be isolated on the equipment end with an insulating bushing to prevent noise from being transferred to the circuit. Equipment racks shall be grounded to the panelboard ground bus utilizing a #8 conductor. Grounding conductor shall be terminated to the rack using connector suitable for that purpose.

3.3 ACCEPTANCE TESTS

After installation has been completed, the Contractor shall conduct acceptance tests, utilizing the approved test procedures, to demonstrate that equipment operates in accordance with specification requirements. The Contractor shall notify the Contracting Officer 14 days prior to the performance of tests. In no case shall notice be given until after the Contractor has received written Contracting Officer approval of the test plans as specified. The acceptance tests shall include originating and receiving messages at specified stations, at proper volume levels, without cross talk or noise from other links or nondesignated units.

3.4 TRAINING

The Contractor shall conduct a training course for 6 members of the operating and maintenance staff as designated by the Contracting Officer. The training course will be given at the installation during normal working hours for a total of 4 hours and shall start after the system is functionally complete but prior to final acceptance tests. The field instructions shall cover all of the items contained in the approved operating and maintenance manuals, as well as demonstrations of routine maintenance operations. The Contracting Officer shall be notified at least 14 days prior to the start of the training course.

-- End of Section --

SECTION 16815A

CABLE TELEVISION PREMISES DISTRIBUTION SYSTEM
10/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70

(2002) National Electrical Code

1.2 SYSTEM DESCRIPTION

The cable television premises distribution system shall consist of coaxial cables and connecting hardware to transport television signals throughout the building to user locations as indicated.

1.3 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 0 to 60 degrees C and in the range of 0 to 95 percent relative humidity, non-condensing.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Cable Television Premises Distribution System; G

Detail drawings including a complete list of equipment and material. Detail drawings shall contain complete wiring and schematic diagrams and other details required to demonstrate that the system has been coordinated and will function properly as a system. Drawings shall include vertical riser diagrams, equipment rack and panel details, elevation drawings of telecommunications closet walls, outlet face plate details for each outlet configuration, and descriptions and types of cables, conduits, and cable trays, if used. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation.

Installation; G

Record drawings for the installed cable system. The drawings shall show the locations of cable terminations, including outlets, and location and routing of cables. The identifier for each termination and cable shall appear on the drawings.

SD-03 Product Data

Spare Parts

Lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval of detail drawings, not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking.

Manufacturer's Recommendations; G

Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be provided prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

Test Plan; G

Test plan defining the tests required to ensure that the system meets technical, operational and performance specifications, 60 days prior to the proposed test date. The test plan must be approved before testing begins. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

Qualifications; G

Proof of the qualifications of the Contractor, Installers, and Manufacturers that will perform the work, and provide the specified products.

SD-06 Test Reports

Testing

Test reports in booklet form with witness signatures verifying execution of tests shall be provided. The cable system testing documentation shall include the physical routing and a test report for each cable (end-to-end) from the installed outlet to the main termination point. Test reports shall be submitted within 14 days after completion of testing.

SD-07 Certificates

Materials and Equipment

Where materials or equipment are specified to conform, be constructed or tested to meet specific requirements, certification that the items provided conform to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, is acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

Commercial, off-the-shelf manuals for operation, installation, configuration, and maintenance of products provided as a part of the cable television premises distribution system. Specification sheets for cable, connectors, and other equipment shall be provided.

1.5 QUALIFICATIONS

1.5.1 Minimum Contractor Qualifications

Work under this section shall be performed, and equipment shall be furnished and installed, in accordance with manufacturer's recommendations by a qualified Contractor as defined herein. The Contractor shall have a minimum of two years of experience in the installation and testing of coaxial cable-based TV distribution systems and equipment. Installers assigned to the installation of this system or its components shall have a minimum of two years of experience in the installation of the specified coaxial cable and components.

1.5.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract shall be products of manufacturers that have a minimum of two years of experience in producing the types of systems and equipment specified.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust or other contaminants.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Cable Television Premises Distribution System materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least one year prior to installation. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70.

2.1.1 COAXIAL CABLE

Coaxial cable shall be RG-59/U, quad shield. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals identifying cable type. Cable shall be rated CMP per NFPA 70. Interconnecting cables shall be cable assemblies consisting of RG-59/U coaxial cable with male connectors at each end, provided in lengths determined by equipment locations as shown.

2.1.2 Outlets

Cable television outlets, including wall outlet plates, shall be equipped with a female connector to accept the connecting coaxial cable from the user's television set. Faceplates provided shall be ivory impact resistant plastic.

2.1.3 OUTLET BOXES

Electrical boxes for cable television outlets shall be 117 mm square by 53 mm deep with minimum 9 mm deep single or two gang plaster ring as shown. Conduits shall be minimum 25 mm .

PART 3 EXECUTION

3.1 INSTALLATION

System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and operation and maintenance manuals.

Necessary interconnections, services, and adjustments required for a complete cable television distribution system, ready to connect to external television signal sources, shall be provided. Penetrations in fire-rated construction shall be firestopped in accordance with Section 07840 FIRESTOPPING. Conduits, outlets, raceways, and wiring shall be installed in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Cables and outlets shall be individually labeled and marked. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with ac power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance and, if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

3.1.1 Horizontal Cable Installation

The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Cable not in a wireway shall be suspended a minimum of 200 mm above ceilings by cable supports no greater than 1.5 m apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 300 mm shall be maintained when such placement cannot be avoided. Cables shall be terminated unless shown otherwise. Minimum bending radius shall not be exceeded during installation or once installed. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered. In raised floor areas, cable shall be installed after the flooring system has been installed. Cable 1.8 m long shall be neatly coiled not less than 300 mm in diameter below each feed point in raised floor areas.

3.1.2 Riser Cable Installation

The rated cable pulling tension shall not be exceeded. Riser cable support intervals shall be in accordance with manufacturer's recommendations. Cable bend radius shall not be less than ten times the outside diameter of the cable during installation and once installed. Maximum tensile strength rating of the cable shall not be exceeded. Cable shall not be spliced.

3.1.3 Outlets

3.1.3.1 Faceplates

Each faceplate shall be labeled with its function and a unique number to identify the cable run.

3.1.3.2 Cables

Cables shall have a minimum of 150 mm of slack cable loosely coiled into the cable television outlet boxes. Minimum manufacturer's bend radius shall not be exceeded.

3.1.3.3 Pull Cords

Pull cords shall be installed in conduits serving the cable television premises distribution system which do not initially have cable installed.

3.2 TERMINATIONS

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. Coaxial cables shall be terminated with appropriate connectors as required. Cable shield conductor shall be grounded to communications ground at only one point and shall not make electrical contact with ground anywhere else.

3.3 GROUNDING

The cable television distribution system ground shall be installed in the cable television entrance facility and in any auxiliary closet identified in Section 16415A ELECTRICAL WORK, INTERIOR or otherwise indicated. Equipment racks shall be connected to the electrical safety ground.

3.4 Spare Parts and ADDITIONAL MATERIALS

The Contractor shall provide the following additional materials required for facility startup:

- a. 10 of each type of connector used.
- b. 10 of each type of cover plate, with connector.

3.5 LABELING

Cables shall be labeled on both ends with circuit number, room number, or other appropriate marking allowing for correct identification of the cable and its destination.

3.6 TEST PLAN

Materials and documentation to be furnished under this specification are subject to inspections and tests. Components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests have been made, demonstrating that the cable television premises distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided. After installation of the cable and before connecting system components, each cable section shall be end-to-end tested using a time domain reflectometer (TDR) to determine shorts, opens, kinks, and other impedance discontinuities and their locations. Cable sections showing adverse impedance discontinuities (greater than 6 dB loss) shall be replaced at the Contractor's expense. There shall be no cable splices between system components unless approved by the Government.

-- End of Section --